Maryland Offshore Wind Project

Outer Continental Shelf Air Permit Application

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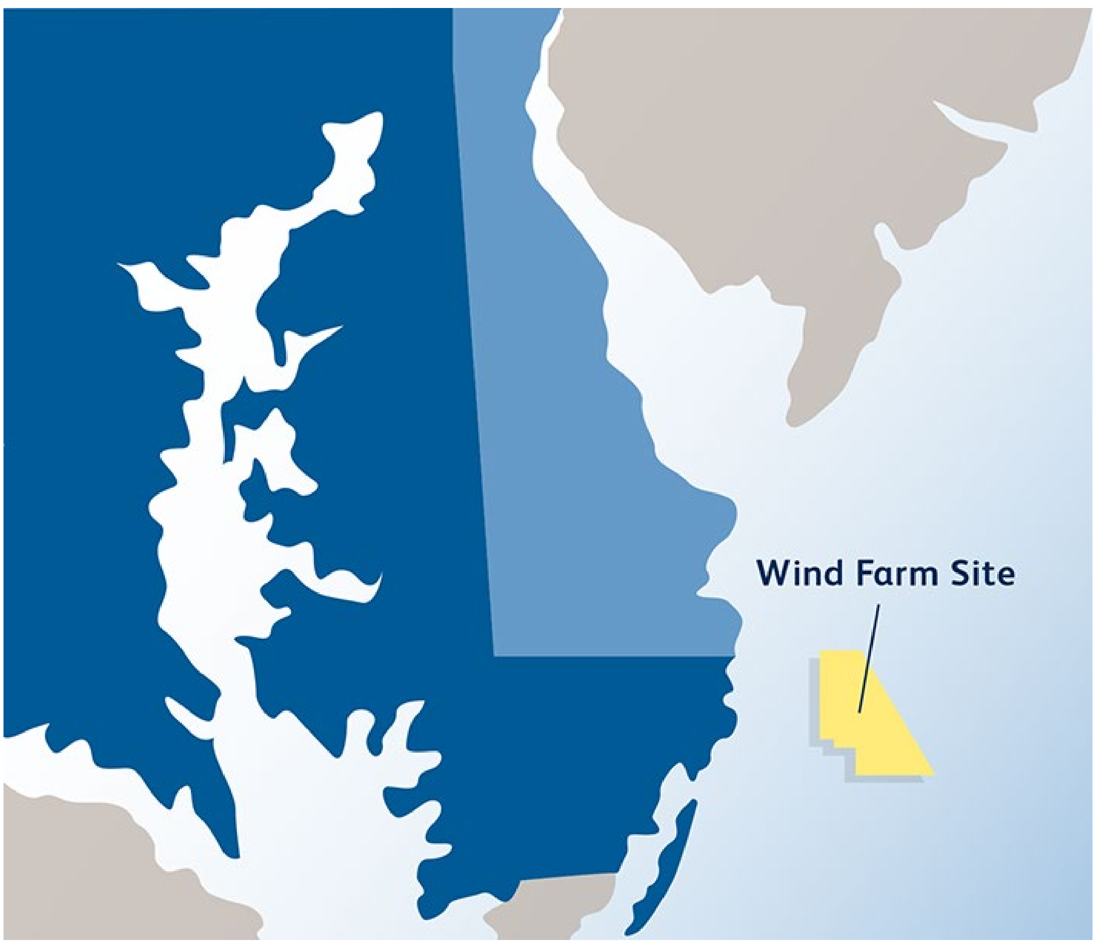

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1.0 INTRODUCTION

US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project (the Project), an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within OCS-A 0490 (the Lease area), a Lease area of approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10.0 nautical miles [NM]) off the coast of Maryland on the outer continental shelf (OCS). The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease area. The Project would be interconnected to the onshore electric grid by up to four (4) new 230-275 kV export cables into new onshore substations in Delaware. US Wind is required by the OCS Air Regulations in 40 Code of Federal Regulations (CFR) Part 55.4, to obtain an air permit for the proposed construction and operation and maintenance (O&M) of the Project.

The Project is scheduled to be installed in up to 4 construction campaigns from 2024 through 2027, with the first phase of the Project commissioned and operational by the end of 2025. Decommissioning would be completed after the 30-year operational phase; a separate Part 55 OCS air permit application would be submitted for decommissioning prior to the conclusion of the operational period.

The Clean Air Act at Section 328(a)(1) requires that the United States Environmental Protection Agency (USEPA) establish air pollution control requirements for OCS sources located within 25 NM of states' seaward boundaries that are the same as onshore requirements. USEPA's implementing OCS Air Regulations, found at 40 CFR Part 55, apply to all OCS sources in federal waters except those located in certain areas of the Gulf of Mexico. OCS sources located within 25 NM of a states' seaward boundaries are subject to the federal requirements set forth in 40 CFR Part 55.13 and the federal, state, and local requirements of the Corresponding Onshore Area (COA) set forth in 40 CFR Part 55.14. Maryland has been designated as the COA. Notable federal, state, and local requirements of the COA incorporated by reference into 40 CFR Part 55.13 and 55.14 that pertain to the OCS air permit application include New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAPs), Prevention of Significant Deterioration (PSD) review, Maryland Department of the Environment (MDE) air regulations at 26 Code of Maryland Air Regulations (COMAR), and Nonattainment New Source Review (NNSR). This OCS air permit application documents compliance with applicable air quality requirements incorporated into the OCS permitting program at 40 CFR Part 55. In accordance with 40 CFR 55.4, the USEPA has delegated the MDE authority to implement 40 CFR Part 55, which requires new OCS stationary sources to obtain a permit from MDE prior to commencing construction. A Notice of Intent (NOI) for the Project was submitted to the USEPA and MDE on August 5, 2022, which is included in the Agency correspondence in Appendix B-1.

This OCS air permit application considers emissions of OCS sources associated with the Project. Emissions are defined pursuant to 40 CFR Part 55 as emissions from OCS sources, which include certain vessels while attached to the seabed or to the Project, and certain vessels traveling to and from the Project when within 25 nautical miles (46.3 kilometers [km]) of the Project's center (the 25-NM [46.3 km] centroid or the OCS centroid). Construction of the Project would involve emission sources attached to and erected upon on the OCS; therefore, an air permit is required by the OCS permitting rules (40 CFR Part 55).

The Project is subject to both federal and state air quality regulations. Worcester County, Maryland is the nearest onshore area (NOA) for the Project, which is also the designated COA. Per 40 CFR Part 55.5, the Project is subject to the applicable requirements of Title 26 of the COMAR Subtitle 11, which have been incorporated into 40 CFR Part 55 by reference and have been listed in Appendix A of the OCS Air Regulations. While the Project is subject to the federal OCS regulations as administered by MDE through an authorization by the USEPA, most of the Project is located within 25 NM of the NOA's seaward boundary, therefore the COA's applicable air quality rules must be addressed in addition to the federal rules that apply throughout the OCS. Figure 1-1 depicts the distances from the centroid of the Project area to several nearby onshore locations to illustrate and support the proposed designation of Maryland as the COA. Figures 1-2 and 1-3 provide the locations of the WTGs, inter-array cable, OSSs, meteorological tower, anticipated vessel routes, and the Project centroid.

The COA for the proposed Project is located in a USEPA-designated attainment area for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM) with an aerodynamic diameter less than 10 micrometers (μm) (PM10), particulate matter with an aerodynamic diameter less than 2.5 μm (PM2.5), and ozone. Because the COA would be located in an area designated as the ozone transport region, the applicability of the NNSR requirements of 26 COMAR 11.17 must also be considered. In this case, the requirements of NNSR apply to new major stationary sources that are major for emissions of ozone precursor pollutants (NO_x and VOC). Pursuant to 26 COMAR 11.17.01.B(17)(a)(ii), any stationary source of air pollution located in Worcester County which emits or has the potential to emit 50 tpy of VOC or 100 tpy of NOx is a major stationary source.

Preconstruction air permitting programs that regulate the construction of new stationary sources of air pollution are commonly referred to as new source review (NSR). Major NSR requirements comprised of PSD and NNSR regulations are established on a federal level but may be implemented by state or local permitting authorities under either a delegation agreement with USEPA or as a SIP program approved by USEPA. MDE adopted the federal PSD permitting program in 26 COMAR 11.06.14 and the federal NNSR permitting program in 26 COMAR 11.17. The Project is not classified as one of the 28 named source categories listed in Section 169 of the Clean Air Act. Therefore, to be considered a "major stationary source" subject to PSD, the facility would need to have potential emissions of 250 tons per year or more of any regulated pollutant (100,000 tons per year for carbon dioxide equivalents (CO2e)).

For projects subject to 40 CFR Part 55, construction emissions apply to the determination of whether the project is subject to the PSD and NNSR permitting process. Potential emissions during Project construction would exceed the 250 tpy PSD major source review threshold and the 100 tpy NNSR threshold for nitrogen oxide (NOx) emissions. Therefore, the Project would be classified as both a PSD and an NNSR major stationary source. A detailed PSD/NNSR applicability assessment is provided in Section 3.2.

Because the Project is subject to PSD and NNSR review, elements of the Project are subject to three requirements related to selection of emissions control technology. These are Best Achievable Control Technology (BACT), Lowest Achievable Emissions Rate (LAER), and State Of The Art (SOTA). Following the prior precedents from approved OCS air permits for offshore wind Projects, US Wind proposes to meet applicable control technology requirements by using vessels with the highest-tiered engines that are available at the time of deployment.

This application documents that the Project would not cause or significantly contribute to any violation of any National Ambient Air Quality Standard (NAAQS). US Wind notes that the peak impacts would be entirely over water miles from shore, where there cannot possibly be any residences, and where the public is extremely unlikely to remain for any extended period. On March 10, 2023, US Wind requested authorization from USEPA to use the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm, as implemented within the AERCOARE program for use in the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD)[1]. The AERCOARE-AERMOD modeling system is an alternative for assessing compliance with air quality standards when emission sources and dispersion occur over water.

1 US Wind submitted a modeling protocol to MDE on September 16, 2022, which initially requested use of the default model for offshore modeling (USEPA OCD model). The MDE and USEPA recommended the use of the alternative AERMOD-AERCOARE model in a December 27, 2022 response letter to the air quality modeling protocol. US Wind provided the MDE and USEPA a revised air quality modeling protocol that included the AERCOARE-AERMOD model on March 10, 2023 (included in Appendix B).

Figure 1-1: Distances to Corresponding Onshore Area

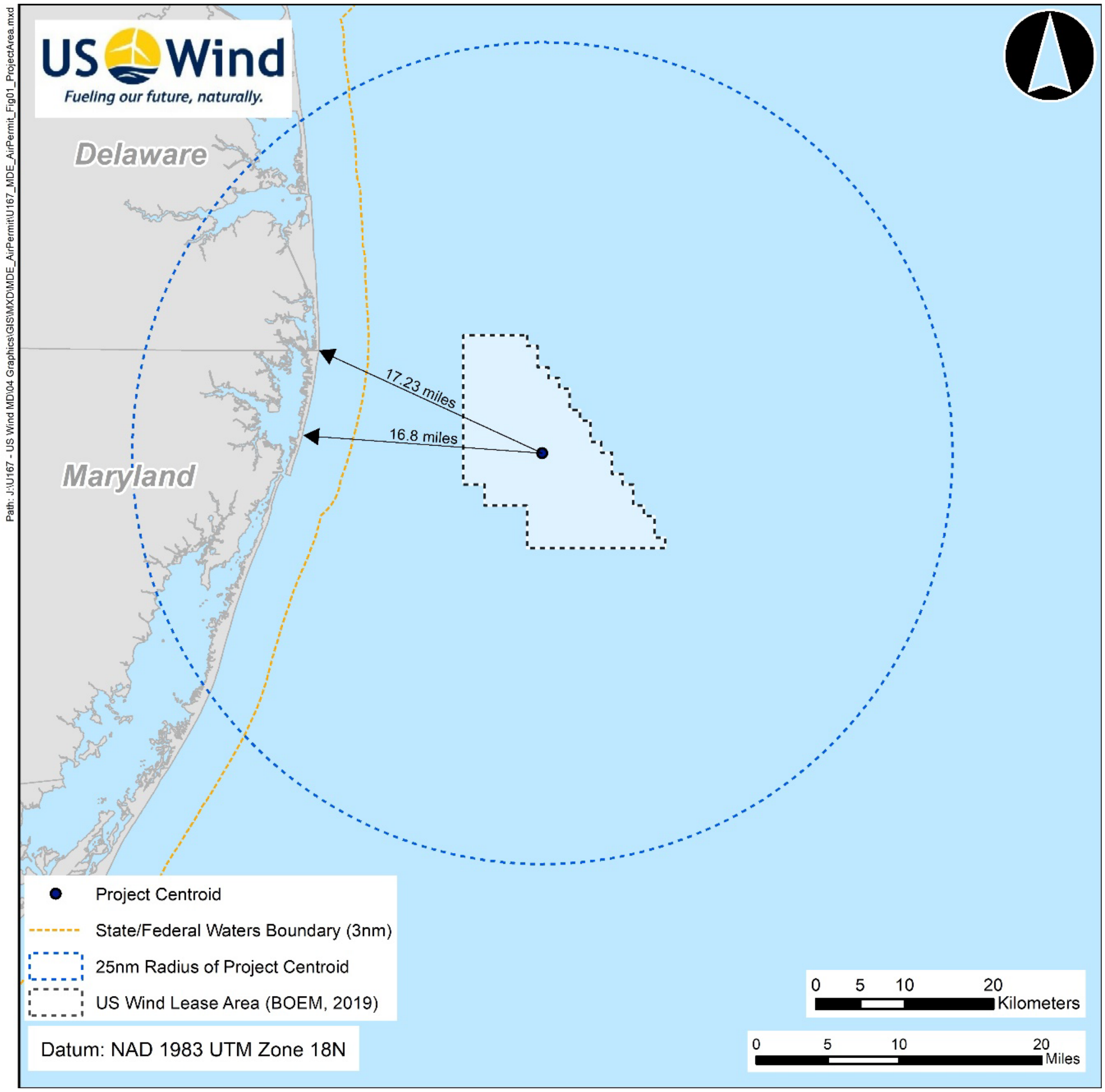
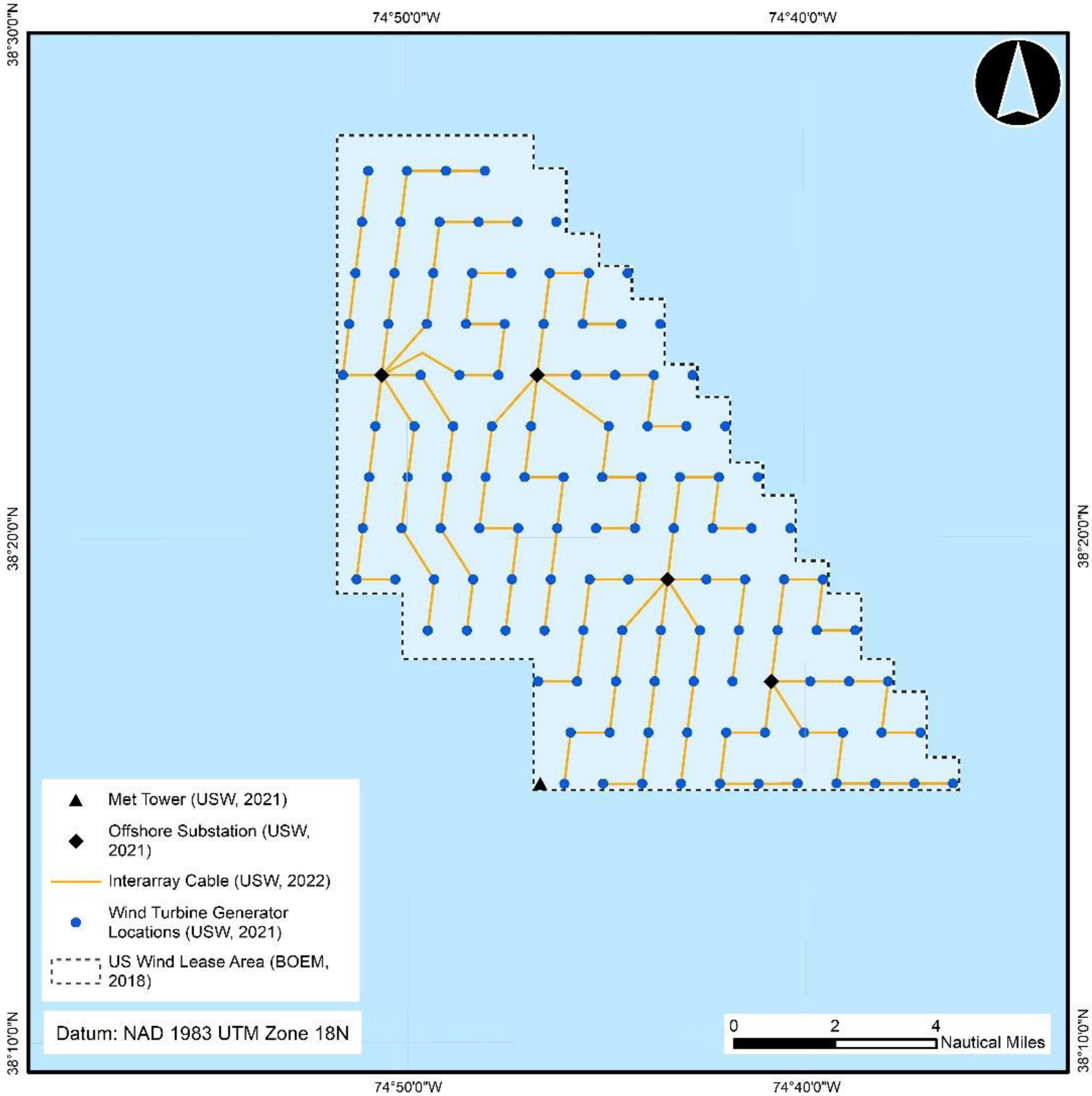


Figure 1-2: Project Location of Maryland Offshore Wind Project

Figure 1-3: Location of WTGs, Inter-Array Cable, and Offshore Substations



2.0 PROJECT DESCRIPTION AND EMISSIONS

The pollutant-emitting activities within the wind development area (WDA) are part of a single plan to construct and operate the Project. For Part 55 OCS air permits, the definition of the WDA[2] comprises the WTGs and their foundations, the OSSs and their foundations, and the inter-array cables. In addition to the windfarm components in the WDA, the facility would include vessels when they meet the definition of an OCS source in Part 55 (i.e., when permanently or temporarily attached to the seabed for the purpose of exploring, developing, or producing resources; or physically attached to an OCS facility).

During construction, pollutant-emitting activities from the windfarm include temporary diesel generators (i.e., engines) used to supply power to the OSSs during commissioning, temporary diesel generators associated with powering noise attenuation technologies, and engines on vessels that meet the definition of OCS source. During the O&M phase, pollutant-emitting activities from the windfarm would include engines on vessels that meet the definition of an OCS source, as well as generators on the OSSs.

As required by Section 328 of the Clean Air Act, when a vessel does not meet the definition of an OCS source, the emissions from vessels servicing or associated with any part of an OCS source are included in the potential emissions from the OCS source when the vessel is within 25 NM of the centroid of the source (OCS Area), including while traveling to and from any part of the OCS facility. Emissions from vessels that would support Project construction and O&M when within 25 NM of the centroid are included in the potential emissions of the OCS facility. The Project construction and O&M activities are summarized below.

The construction of the Project is proposed for up to 4 campaigns. Each construction campaign would follow this general sequence:

- Installation of the OSS;
- Offshore export cable installation;
- WTG monopile foundation installation;
- Inter-array cable installation;
- WTG installation; and
- WTG commissioning.

The types of emissions activities included in the construction and O&M phases are described as follows.

Construction emissions would consist of the following activities:

[2] The WDA is equivalent to the Lease area shown in Figure 1-1 and 1-2.

- Vessel transit within the OCS area (i.e., 25 NM from the centroid as shown on Figure 1-1);
- On-vessel equipment usage including diesel generators;
- Onsite maneuvering at the WTGs and at the OSSs;
- Export and inter-array cable laying within the OCS area; and
- Commissioning activities (e.g., temporary diesel generators).

O&M emissions would consist of the following activities:

- Vessel transit within the OCS area;
- Onsite maneuvering at the WTGs and OSSs; and
- Onsite emergency generators on the OSS.

Potential emissions resulting from the Project fall into two broad categories: 1) direct emissions from the OCS source(s) when regulated as a stationary source and 2) emissions included in the potential emissions of the OCS source. Emissions in the first category occur only during the time when a piece of equipment, an activity, or facility (which may include a vessel) meets the definition of an OCS source. Emissions in this category would be subject to specific emission limits of the OCS permit and to federal regulations governing stationary sources including New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP).

Emissions in the second category include all potential emissions associated with the Project, including emissions from vessels while enroute to and from an OCS source when within 25 NM of the OCS source. Emissions in this category are utilized when:

1. Determining applicability of Clean Air Act (CAA) permit programs (NNSR, PSD, and CAA Title V operating permits); and
2. Modeling potential impact of Project on Class I and II areas and ambient air, as applicable.

Air emissions associated with the construction and O&M phases of the Project depend on many factors, such as location, scope, type, capacity of equipment, and schedule. Potential emissions would be generated by emission sources associated with the Project, such as engine exhaust from marine vessels and heavy equipment/engines used during construction. Air pollutants emitted during the Project's construction and O&M phases would include NO_x, VOC, CO, PM10, PM2.5, greenhouse gas emissions as carbon dioxide equivalents (CO_2e), SO_2, and total hazardous air pollutants (HAPs, individual compounds are either VOC or particulate matter). The potential emissions have been estimated separately for the construction phase (including commissioning) and the O&M phase. Decommissioning of the Project would be completed after the 30-year operational phase; therefore a separate OCS air permit application would be submitted for decommissioning at a later date prior to the conclusion of the O&M phase.

Construction vessels would transit between onshore support/staging facilities at potential ports located in Maryland, Virginia, or New Jersey and the Project work area. It is anticipated that the large construction vessels would be staged at Sparrows Point in Baltimore, Maryland, while support vessels for crew transfer would stage from Ocean City, Maryland during both the construction and O&M phases. Most of these vessels and onboard construction equipment would utilize diesel engines burning low sulfur fuel.

The Project would be constructed in up to four campaigns; therefore some portions of the wind farm would be under construction while other parts would be operational. Annual construction emissions reflect these overlapping periods by including O&M emissions for WTGs that have been commissioned and are operational while the remainder of the WTGs and OSSs are constructed and commissioned.

US Wind proposes to implement continuous development and construction to efficiently develop the Project and fulfill existing and potentially future obligations. This construction approach is necessary as a result of various factors, such as varying permitting timelines, manufacturing timelines, vessel availability, supply chain dynamics, technological adjustments, and seasonal restrictions. This approach will also ensure that construction impacts are minimized and streamlined. An indicative Project schedule for the phased development is summarized below for the proposed schedule. Timeframes are identified by the 3-month quarter (Q) of that respective year.

Indicative Project Schedule (subject to change)_

Initial Construction Campaign

- Foundations Q2 2025 to Q4 2025
- Submarine Cable Q2 2024 to Q1 2026
- Offshore Substations Q2 2024 to Q3 2025
- Wind Turbine Generators Q2 2025 to Q1 2026

Second and Third Construction Campaigns

- Foundations Q2 2025 to Q4 2026
- Submarine Cable Q3 2025 to Q3 2026
- Offshore Substations Q2 2024 to Q3 2025
- Wind Turbine Generators Q2 2026 to Q1 2027

Fourth Construction Campaign

- Foundations Q2 2027 to Q4 2027
- Submarine Cable Q3 2026 to Q2 2027
- Offshore Substations Q3 2026 to Q3 2027
- Wind Turbine Generators Q2 2027 to Q1 2028

The construction start date for an OCS air permit is the first day any equipment or activity, that meets the definition of an OCS source, operates, occurs, or exists in the WDA. US Wind expects that the first OCS source would be a jack-up vessel for foundations/OSS construction.

Additional details about the Project beyond that included in this application can be found in the Construction and Operations Plan[3] (COP) submitted to the Bureau of Ocean Energy Management (BOEM).

2.1 OCS Sources

USEPA's implementing OCS Air Regulations at 40 CFR Part 55 adopt the statutory definition of an OCS source from Section 328(a)(4)(c) of the Clean Air Act (CAA): "any equipment, activity, or facility which—(i) emits or has the potential to emit any air pollutant, (ii) is regulated or authorized under the Outer Continental Shelf Lands Act [43 U.S.C. 1331 et seq.], and (iii) is located on the Outer Continental Shelf or in or on waters above the Outer Continental Shelf." The regulations at 40 CFR Part 55 state that vessels are only considered OCS sources when they are: "(1) Permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom, within the meaning of section 4(a)(1) of OCSLA (43 U.S.C. Part 1331 et seq.); or (2) physically attached to an OCS facility, in which case only the stationary sources aspects of the vessels will be regulated."

As described in the USEPA's South Fork Wind, LLC OCS preconstruction Air Permit Fact Sheet[4], "attachment" for the purposes of being an OCS source does not mean "any physical connection." Rather, the purpose of the "attachment" must be to "prevent or minimize relative movement" between the vessel and the seabed. USEPA also found that in order for a vessel to be "erected" on the seabed, it must remain stationary while it conducts its OCS activity and be located where the OCS activity (i.e., generation of power) is reasonably expected to occur. US Wind would generate power in the Wind Turbine Array area (WTA); vessels outside the WTA would not be considered OCS sources. USEPA also explained that the terms "exploring," "developing," and "producing," as defined in OCSLA, do not include construction other than platform construction. Therefore, vessels used must contribute to platform construction (i.e., construction of the WTGs, OSSs, and/or foundations) to meet the definition of OCS source. A connection to the seabed or another OCS source, does not make a vessel an OCS source if the vessel does not use that connection to remain stationary (relative to the seabed).

During the construction and commissioning phase, it is anticipated that the first aspect of the Project to meet the definition of an OCS source would be a jack-up vessel for the OSS and WTG installation activity. The jack-up vessel would be temporarily attached to and erected on the seabed and used for the purpose of developing or producing resources (i.e., wind-generated electricity) from the OCS. Then the jack-up vessel would detach from the seabed and move to

[3] https://www.boem.gov/renewable-energy/state-activities/us-wind-construction-and-operations-plan
[4] https://www.epa.gov/system/files/documents/2021-07/south-fork-draft-permit-fs.pdf

the next installation location. The jack-up vessels would only be in a specific location for less than a week on average before moving to the next installation location. While the temporal duration of the OCS sources would be short and intermittent, the project has conservatively aggregated these activities together within the WTA during the construction and commissioning period, consistent with USEPA's source determination for the South Fork Wind Farm.

As a further conservative assumption for purposes of the OCS air permit, and because the exact travel and work schedule of each vessel is difficult to predict, it is assumed that all vessels within 25 NM of the centroid of the WTA area are included in the potential emissions of the construction and commissioning phase of the Project, including those which are anticipated to be utilized prior to the first instance of an OCS source. Based on the source determination analysis for offshore wind projects, the construction and commissioning activities within the WTA area are considered a single OCS source, with the centroid of the WTA area serving as the centroid of the 25 NM radius circle.

Consistent with recent precedent established by USEPA as discussed below, US Wind interprets "within 25 miles of the source" to mean the distance is based on the centroid of the work area (WA) (i.e., the WTA area), which is the equivalent to the centroid of the BOEM lease area. The use of the WA centroid is appropriate when calculating potential emissions because calculating the distance traveled to any specific OCS source would not result in a total calculated emission rate substantively different than calculating emissions based on the WA centroid. For example, the total amount of distance travelled one-way to the 121 WTGs from the Sparrows Point port is approximately 5,600 kilometers based on the 25 NM distance traveled either from the actual WTG location (i.e., an OCS source) or from the WA centroid. Thus, the resultant to and from 25 NM emissions would be identical for the vessels traveling to the WTGs from the Sparrows Point port using either the WA centroid approach or the actual OCS source locations approach.

Note that calculating distances to the WA boundary would be unnecessarily conservative and complex, and calculating distances to each individual OCS source would be unnecessarily complex. To the extent that vessels will be required to document emissions and other operating parameters while operating within 25 NM of the OCS source, the requirement to recalculate that distance each trip would become cumbersome (and possibly infeasible as vessels' destinations could change mid-trip due to changing weather or other circumstances).

The Projects' activities are evenly spaced across the WA, and longer and shorter distances will tend to even out in the overall annual OCS air emissions calculation. For the purposes of determining the centroid of the WA, US Wind utilized GIS software and the geographical extents of the BOEM lease area OCS-A 0490. Note that the use of the WA is appropriate as it includes vessel activities associated with WTGs and their foundations, OSS and their foundations, and the offshore met tower and its foundation and is based on the PDE. The use of the WA centroid for OCS air permitting purposes is consistent with the maximum PDE approach and includes the potential for US Wind to construct and operate all of the Project components in the PDE. As discussed by USEPA for the South Fork Wind Project OCS air permit, this is a sensible approach to calculate emissions and will provide US Wind, MDE, and USEPA with certainty for OCS air permitting and enforcement.

As described in the USEPA's South Fork Wind, LLC OCS preconstruction Air Permit Fact Sheet[5], the centroid approach is appropriate for OCS applications based on the following discussion by USEPA:

> *"For the purposes of determining the potential emissions, the USEPA has determined it is appropriate to use the center of the WA, i.e., the centroid, as the point to estimate vessel emissions within 25 nautical miles of the facility. With a fixed point, SFW will be accounting for vessel emissions sometimes from slightly more than 25 nautical miles from the OCS source and sometimes less. The use of a centroid should result in a slight overestimate of emissions on some days canceling out the slight underestimate of emissions on other days. Using the center as the point to estimate emissions is a sensible approach for permitting and enforcement purposes and provides greater certainty for the USEPA and the permit applicant."*

There is one OCS source associated with the construction and commissioning phase of the Project, which is the WTA area. The OCS source includes all vessels associated with the construction and commissioning phase of the Project when those vessels are on-site (within the WTA area) or enroute to or from the WTA area when within 25 NM of the centroid of the WTA area. The potential emissions presented in this air permit application represent estimated emissions occurring within this circle.

During the construction and commissioning phase, the following emission units would be considered OCS sources for a portion of time during the construction and commissioning phase. Emissions from all other emission units are included in the potential emissions of the Project but are not regulated as stationary source emissions.

1. Jack-up vessels - The Project would employ jack-up vessels during foundation installation and WTG construction. Jack-up vessels have legs that extend to the ocean floor to elevate the hull above the ocean surface which provides a safe and stable work environment. Once at least three of the jack-up vessel's legs have attached to the seafloor, it is considered an OCS source because the jack-up unit has become stationary and is no longer operating as a vessel. During the time three or more legs are attached to the seafloor, emissions from the vessel engines are regulated as stationary sources and would be subject to specific emission limits of the OCS air permit, as well as NSPS and NESHAP.

[5] https://www.epa.gov/system/files/documents/2021-07/south-fork-draft-permit-fs.pdf

2. OSS Generators - During commissioning, there is assumed to be a diesel-fired engine powering a generator installed on each OSS. During the time the engine generator is installed on the OSS, the OSS is considered an OCS source and emissions from the engine are regulated as stationary sources.

3. Vessels attached to an OCS source - During construction and commissioning, fleet vessels may temporarily attach to a structure that is at that time considered an OCS source or to another vessel that meets the definition of an OCS source. The stationary source aspects of the vessels would be regulated while the fleet vessels are attached to an OCS source.

During the Project's O&M phase, emissions would be far less than during construction. The operation of the WTGs would not generate air emissions and only the OSSs would meet the definition of an OCS source as they would be attached to the OCS and would have emissions from diesel electric generators. The generators located on the OSSs would complete weekly and annual testing during the Project's O&M phase. O&M activities would also likely consist of small vessels transiting to and from the Project to service the WTGs or the OSSs over the 30-year operational life. Crew transport vessels and service operations vessels would transport crew and equipment to the offshore Project area for inspections, routine maintenance, and repairs.

A summary of air emission sources for WTG installation and commissioning as well as cable laying and OSS construction and commissioning are shown in Tables 2-1 and 2-2. The types of vessels expected to be used for the Project are listed and were classified as consistent with the equipment types used within the BOEM emission estimating tool.

A complete description of all of the emission sources associated with the Project, including engine sizes, hours of operation, load factors, emission factors, and fuel consumption rates are provided in Appendix A, Tables A-2 through A-15. US Wind developed the engine sizes and calculated the hours of operation based on information prepared by the US Wind construction management team. US Wind assessed the vessels from other recently approved OCS air permits that may be used for the Project or are closely representative of the type of vessels that are expected to be used for the Project.

2.1.1 Support Vessels

Most of the air emissions from the Project would come from the main and auxiliary engines of the various construction equipment and vessels. For a vessel to be considered an OCS source, it must be permanently or temporarily attached to the seabed and also erected on the seabed for the purposes of exploring, developing, or producing resources. In accordance with the Environmental Appeals Board (EAB) decision in roe Shell Gulf of Mexico, Inc. and in re Shell

Offshore, Inc., 15 EAD 193 (220)[6], the potential emissions of an OCS source must also include emissions from associated support vessels when they are within 25 NM of the OCS source, but only during the time it is considered an OCS source (i.e., attached to the seabed).

Anchor-pulling vessels associated with offshore export cable installation (on waters above the OCS) are temporarily attached to the seabed, however, the vessels are not erected on the seabed because they do not remain stationary at the location of the OCS activity. Additionally, anchor-pulling vessels and their activities are not considered “exploring for, developing, or producing resources” as defined in the Outer Continental Shelf Lands Act (OCSLA), as these terms are defined in the context of platform construction and anchor-pulling vessels associated with the offshore export cable installation are not used for platform construction. The USEPA determined that, although pull-ahead anchor vessels are attached to the seabed, this equipment does not meet the other two criteria for classifying a vessel as an OCS source and, therefore, should not be subject to the permitting requirements applicable to OCS sources[7].

In addition to the potential use of anchor-pulling vessels for export cable installation, US Wind may also use dynamic positioning system (DPS) vessels. A dynamic positioning system uses computer-controlled thrusters to maintain position along the cable route, and the ship’s forward momentum comes from its own on-board propulsion, not winches and anchors. The USEPA has determined that cable laying vessels are not OCS sources when these vessels are using a DPS (a computer-controlled system of thrusters with no anchors) to advance and maintain lateral position along the export cable route[8]. DPS vessels may not be permanently or temporarily attached to the seabed and as such, DPS vessels are not OCS sources only on that basis. Additionally, DPS vessels are neither erected thereon nor used for the purpose of exploring, developing or producing resources therefrom. As such, USEPA has determined that cable-laying vessels using either a pull-ahead anchor system or a dynamic positioning system do not meet the criteria to qualify vessels as OCS sources.

However, consistent with previous decisions, USEPA has determined that emissions from cable laying vessels should be included in the potential to emit of the OCS source when located at or traveling within 25 NM of the centroid of the OCS area[9]. It is difficult to predict which support vessels would be enroute to and from a vessel while it is considered an OCS source at the Project site (for example, which vessels would be enroute while a jack-up vessel is jacked up). Therefore, for purposes of the OCS air permit, all vessels within 25 NM of the centroid of the wind turbine array are conservatively included in the potential emissions of the construction phase of the Project, including those which are anticipated to be utilized prior to the first instance of an OCS source. Therefore, the OCS source includes all vessels associated with the construction phase of the Project when those vessels are on-site (within the wind turbine array

[6] https://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/Decision~Date/4E0547DAD63F032F852578540048BEC3/$File/Shell%20Gulf%20of%20Mexico%20II.pdf
7 June 24, 2021 Fact Sheet for South Fork Wind can be accessed at https://www.epa.gov/caa-permitting/south-fork-wind-llcs-south-fork-windfarm-outer-continental-shelf-air-permit
8 EPA Memorandum, Source Determination Analysis for Vineyard Wind OCS Windfarm (June 26, 2019)
9 June 24, 2021 Fact Sheet for South Fork Wind.

area) or enroute to or from the wind turbine array area when within 25 nautical miles[10] of the centroid of the wind turbine array area.

2.2 Project Emissions

Unlike traditional fossil-fuel based energy generation, the Project's WTGs would not generate air pollutant emissions. Instead, the electricity generated by the WTGs has the potential to significantly reduce emissions from the regional electric power grid over the life of the Project by displacing electricity generated from pollution-emitting fossil fuel- fired power plants that otherwise would be required to serve the projected increase in electric demand within regional electric markets.

While the WTGs would not generate air emissions, air emissions would occur in connection with Project construction and O&M. Air emissions from these activities are directly associated with internal combustion engines generating power for vessels, vehicles, and tools needed to support the various phases of the Projects.

The CAA and implementing Federal and State regulations, requires the USEPA to establish National Ambient Air Quality Standards (NAAQS) for pollutants that are considered harmful to public health and welfare and the environment. These pollutants come from a diverse set of sources, including cars and trucks, electric power plants, factories, office buildings, and residences. USEPA has established NAAQS for six air contaminants, known as criteria pollutants. These criteria pollutants are sulfur dioxide (SO_2), particulate matter (with a diameter smaller than 10 microns as PM10 and a diameter smaller than 2.5 microns as (PM2.5), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and lead (Pb).

In addition to these criteria pollutants, Project activities would also generate greenhouse gas (GHG) emissions and hazardous air pollutant (HAPs) emissions. A GHG is an atmospheric gas that slows the rate at which heat radiates from earth into space, thus having a warming effect on the atmosphere. Carbon dioxide (CO_2) is the most common GHG, but the Project also has the potential to emit other GHGs such as methane (CH_4), and nitrous oxide (N_2O). GHG emissions are presented as carbon dioxide equivalent (CO_2e). Each GHG has an associated Global Warming Potential (GWP) that correlates the global warming effects of the compound to that of CO_2, which has a base value of one (for example, methane has a GWP of 25, which means each ton of methane has the equivalent greenhouse effect of 25 tons of CO_2). GHGs are typically multiplied by their GWP values to express the total as CO_2e. Global Warming Potentials for GHG compounds are from Table A-1 of 40 CFR Part 98, Subpart A.

HAPs are compounds that at varying exposure levels are known or suspected to cause serious health effects (e.g., certain forms of cancer or birth defects) or can result in serious adverse environmental effects. Some examples of HAPs are acrolein, formaldehyde, and cadmium.

[10] A unit of nautical miles is used in accordance with EPA interpretation of the Part 55 regulations.

HAPs may be emitted from fossil fuel combustion (due to the presence of impurities or products of incomplete combustion) and from industrial processes that involve the use of toxic chemicals. HAPs are a subclassification of PM and VOC emissions where a small portion of VOC or PM emitted are also classified as HAP emissions.

The pollutants that are included in the emissions estimates for the Project are:

- Nitrogen Oxides (NO_x)
- VOC
- CO
- PM
- PM10
- PM2.5
- SO_2
- Pb
- Total HAPs
- GHGs (CO_2, CH_4, and N_2O)

The emissions estimates are calculated based on approximations of representative vessels, engine sizes, and hours of operation that reflect the current state of the design of the Project at the time of the submission of this application. It is not possible for US Wind to know the exact vessels that would be used or the operation time that would be necessary until a short time before construction begins as there are limited vessels capable of performing the actions necessary to construct and operate an offshore wind farm and demand for these vessels is increasing.

US Wind notes that the approach to calculating emissions discussed above is consistent with the approaches approved by the USEPA in the South Fork Wind, LLC OCS preconstruction Air Permit Fact Sheet and the Revolution Wind OCS Air Permit Fact Sheet[11]. USEPA provides the following determination in the BACT approval for South Fork Wind:

> *"At the time of this document, the vessel needs for installation of WTGs and the OSS change on short notice and require contracts within short timeframes. All internal combustion engines operated on OCS vessels will be operated by third parties, i.e., not by SFW. Therefore, the size and installation date of the engines are unknown. The USEPA is considering these facts in determining BACT for the project."*

Section 4 of this application provides a detailed BACT/LAER analysis that details the appropriate emission factors and vessel engines utilized in the emissions assessment.

11 https://www.epa.gov/system/files/documents/2023-03/fact-sheet-draft-revolution-wind-ocs-air-permit-ocs-r1-05.pdf

2.2.1 Emission Sources During Construction and Commissioning

Emissions from the Project would be generated by the main engines, auxiliary engines, and equipment on vessels used during construction and commissioning activities. Emissions from marine vessel engines would also be generated while vessels maneuver within the WDA, during installation of the offshore export cables, and during vessel transit to and from port.

Construction of the Project would require the use of an array of vessels. During construction, heavy lift vessels, tugboats, barges, and jack-up vessels would be used to transport the WTG, monopiles, transition pieces, and OSS components to the WDA. Installation of the WTGs, monopiles, transition pieces, and OSSs is expected to be performed using a combination of jack-up vessels and crane vessels. It is anticipated that scour protection would be installed around the WTG and OSS foundations. Cable-laying is expected to be performed by specialized cable-laying vessels. Crew transfer vessels are expected to be used to transport personnel to and from the WDA and may be used for marine mammal observations.

Additional offshore construction-related emissions would be generated by diesel generators used to supply power to the OSSs before cabling is in place. Offshore emissions would also be generated by air compressors used to supply compressed air to noise mitigation devices (e.g., bubble curtains) during pile-driving, and diesel engines used to power the hydraulic pile driving hammer.

2.2.2 Emission Sources During Routine Operations and Maintenance

During the Project's up to 30-year operational period, the WTGs would not generate air emissions. Rather, electricity generated by the WTGs would displace electricity generated by higher-polluting fossil fuel-powered plants and significantly reduce emissions from the regional power grid over the lifespan of the Project.

Emission sources during O&M that are subject to the OCS air permit would include:

- Crew transfer vessels;
- Service operation vessels;
- Multipurpose offshore support vessels;
- Tugboats;
- Jack-up vessels; and
- Stand-by generators.

During the O&M phase, US Wind's offshore facilities would be routinely inspected. In addition, proactive replacement of parts and other preventative maintenance would be conducted. A more detailed description of offshore operations and maintenance activities is provided in the BOEM Construction and Operations Plan.

For routine O&M, there are two primary activities. Crew transfer vessels would frequently transport crew to the WDA for inspections, routine maintenance, and minor repairs. A service operation vessel, which provides accommodations and workspace, if used, may remain at the WDA for several weeks at a time. Workers would access the WTGs and OSSs to perform routine O&M via a gangway directly from the service operation vessel or a small crew transfer vessel.

Other larger support vessels, such as jack-up vessels, may be used infrequently for some O&M activities. When these vessels are within 25 NM of the WTGs or OSSs, their air emissions are included in the Project's potential emissions.

2.2.3 Calculation Methodology

Emissions are from internal combustion engines from marine vessels and offshore generators and are quantified using a three-step process:

- Detailed plans for each activity.
- Engine load factors.
- Emission factors.

Air emissions are broadly calculated as the product of engine rated capacity; hours operating; load factor; and emission factor.

2.2.3.1 Marine Vessels

Emissions from the engines on the marine vessels were calculated according to the methodology described in BOEM's Offshore Wind Energy Facilities Emission Estimating Tool Technical Documentation, referred to as the "BOEM Wind Tool". Estimates in this application are based on Version 1 of the BOEM Wind Tool. BOEM recently released an updated version (Version 2.0) of the BOEM Wind Tool in 2021, however this tool makes the assumption that all vessel engines are Category 2 USEPA Tier 1 marine engines and applies the same emission factors to all marine vessel types and engines. Version 1 of the BOEM Wind Tool, which has marine engine emission factors based on fleet-weighted averages for each vessel type, is more appropriate and accurate for an estimate of air emissions, especially given the wide range of vessel types and engine sizes expected to be used during construction, commissioning and O&M of the Project.

To further elaborate on the use of Version 1 of the BOEM Wind Tool, the following list of advantages of Version 1 of the Wind Tool is provided.

1. Version 1 provides emissions factors for all criteria pollutants and GHGs. Version 2 only provides emission factors for NO_x, PM2.5, SO_2, and CO_2.
2. Version 1 provides emission factors based on appropriate USEPA engine categories and emissions tiers to create weighted emission factors that account for variances in the vessel fleet for each vessel category. Version 2 provides a single factor for all vessel engine sizes and tiers (i.e., based on engine speed, age, and USEPA classification).
3. Version 2 uses a single emission factor for all vessel engine powers, displacement, ages, and speeds, which is inadequate for an OCS air permit application that requires a BACT/LAER analysis. See Section 4 for a detailed BACT/LAER analysis.
4. The USEPA has approved the use of Version 1 emission factors for recent OCS air permits issued for the Vineyard Wind 1 Project (EPA Permit Number OCS-R1-03-M1), Revolution Wind Project (EPA Permit Number OCS-R1-05) and the South Fork Wind Project (EPA Permit Number OCS R1-04).

As discussed above, Version 1 of the BOEM Wind Tool provides emissions factors based on the fleet of engine power, displacement, age, and USEPA tier. Version 2 assumes that all engines are classified as Category 2 USEPA Tier 1 engines. Table 2-3 provides a comparison of the NO_x and PM2.5 emission factors based on a range of engine categories and USEPA emissions tiers for both versions of the BOEM Wind Tool. The PM2.5 and NO_x emission factors for Version 1 are higher than those in Version 2 for nearly all engine categories and USEPA emission tiers. This demonstrates that the Version 2 emission factors are inadequate for the purposes of preparing emission calculations for an OCS air permit application as the single set of emission factors is arbitrarily applied to all engines, regardless of actual USEPA Tier certification and classification. As an example, US Wind calculated that the maximum annual PM2.5 emissions to be 12.6 ton per year based on Version 2 of the Wind Tool and 19.4 tons per year based on Version 1 of the Wind Tool. Thus, it can be concluded that use of Version 2 of the Wind Tool may result in emissions calculations that are lower than otherwise would be anticipated based on the fleet of vessels. US Wind selected Version 1 of the BOEM Wind Tool for this application.

Emissions estimates from vessel engines are calculated for two different modes of operation. The first is when the engines are operating in transit mode to represent when the vessel is traveling at transit speed between the port and the Project area. The other is when the vessel engines are in maneuvering mode to represent when the vessel is operating in the Project area. The general formula used for estimating emissions from these two engine modes is as follows:

$E = \text{Engine Power} * \text{Operating Time} * LF * EF * 1.10231 \times 10^{-6}$

Where:

- E = total emissions (US tons)
- Engine Power = total engine size (kilowatt [kW])
- Operating Time = duration of each activity (hours)

- LF = engine load factor (unitless)
- EF = emission factor (g/kW-hr)
- 1.10231×10^{-6} = grams to ton conversion factor

The hours of operation for each vessel are determined based on the estimated necessary time needed to construct or operate the Project. For transit hours, the number of trips to port, the assumed vessel speed, and the distance to the port for each vessel were used to calculate the number of hours spent traveling between port and the Project area. For maneuvering, the number of hours of operation necessary were estimated based on the anticipated number of days required to complete the action the vessel is performing.

A load factor represents the portion of utilized engine power compared to the maximum rated engine power. Load factors vary from 0 (engine off) to 1 (engine fully utilized) based on a variety of factors. The BOEM Wind Tool provides default load factors for main and auxiliary marine vessel engines during transit and on-site maneuvering for types of vessels that are based on national fleet data compiled from IIHS's Register of Ships. The BOEM Wind Tool uses a default load factor of 0.83 for main engines in transit and 0.20 for main engines during maneuvering, which are consistent with other available sources of marine vessel load factors for propulsion engines at cruise speed and during maneuvering. Jack-up vessels use legs to remain in place while on-site, so it is assumed that jack-up vessels do not use main engines during on-site maneuvering.

The BOEM Wind Tool provides a default load factor of 1 for all auxiliary activities. Auxiliary engines would not be always engaged at full power; therefore, more representative load factors were selected for auxiliary engines. The auxiliary engine load factors are based on several different sources. Load factors for auxiliary engines on vessels with category 1 or 2 main engines were derived from Table 4 of the Auxiliary and Boiler Power Surrogates of the Eastern Research Group [12] document that was used as supporting documentation in the 2017 National Emissions Inventory (NEI). For vessels with category 3 main engines, the load factors are derived from Table 4-17 of the 2014 NEI for Commercial Marine Vessels [13]. Vessels are conservatively assumed as operating on the maneuvering load factor for operating days spent in Project Area.

For HAP emissions, the HAP speciation for marine vessels from the 2017 NEI supporting document titled "NEI Development Documentation - Methodology Documentation for USEPA's Commercial Marine Emissions Estimates [14]" was used. This document provides the fraction of PM2.5 and VOC that corresponds to each HAP and was used to generate a total ratio of HAP to VOC and PM that is applied to calculate the HAP emission factor for each vessel category.

[12] https://www.epa.gov/sites/default/files/2019-11/cmv_methodology_documentation.zip
[13] https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data
[14] USEPA: 2017 NEI Development Documentation - Methodology Documentation for EPA's Commercial Marine Emissions Estimates

The expected ports and transit speeds for each vessel are provided in the main calculation tables found in Appendix A, Tables A-2 through A-15.

A sample calculation using the above methodology is provided below for the propulsion engines associated with a crew transfer vessel as this type of vessel will be the most frequently utilized vessel type during construction and O&M. The details for this calculation are provided in Tables A-37 through A-39.

<u>Crew Transfer Vessel – Operation Period</u>

INPUTS
Propulsion Engine Size – 2 x 749 kW = 1,498 kW total
Load Factors: 0.83 – Transit
0.20 – Maneuvering
Vessel Speed in Transit within 25 NM of OCS Source – 25 knots
Round Trip Distance Traveled – 32.55 NM (Ocean City Port)
Number of Annual Round Trips – 365
Number of Daily Operating Hours – Maneuvering – 12 hours

CALCULATIONS
Number of Annual Operating Hours – Transit = 475 hours (32.55 NM * 365 days / 25 knots)

> **Number of Annual Operating Hours - Transit** = number of annual round trips [32.55 NM] * assumed operating days [365] / vessel speed in transit within 25 NM of OCS source [25 knots]

Number of Annual Operating Hours – Maneuvering – 4,380 hours (12 hr/day * 365 days)

> **Number of Annual Operating Hours - Maneuvering** = number of daily operating hours [12 hours] * assumed operating days [365]

Emission Factor – NO_x (g/kW-hr) = 1.8 (Based on EF Ref #12 in Table A-40)

Hourly Emissions – Transit = 4.93 lb/hr (1,498 kW * 0.83 * 1.8 g/kW-hr * 1/453.6 g/lb)

> **Hourly Emissions - Transit** = engine size [1,498 kw] * load factor [0.83] * emission factor [1.8 g/kw-hr] * grams to lb conversion [1 lb / 453.6 grams]

Hourly Emissions – Maneuvering = 1.19 lb/hr (1,498 kW * 0.20 * 1.8 g/kW-hr * 1/453.6 g/lb)

> **Hourly Emissions – Maneuvering** = engine size [1,498 kw] * load factor [0.20] * emission factor [1.8 g/kw-hr] * grams to lb conversion [1 lb / 453.6 grams]

Annual Emission – Transit = 1.17 tons/year (4.93 lb/hr * 475 hrs/yr * 1/2000 lb/ton)

> **Annual Emissions – Transit** = hourly emissions - transit [4.93 lb/hr] * annual hours per year in transit [475 hours] * lb to ton conversion [1 ton / 2,000 lb]

Annual Emission – Maneuvering = 2.61 tons/year (1.19 lb/hr * 4,380 hr/yr * 1/2000 lbs/ton)

> **Annual Emissions – Maneuvering** = hourly emissions - maneuvering [1.19 lb/hr] * annual hours per year maneuvering [4,380 hours] * lb to ton conversion [1 ton / 2,000 lb]

Total Annual Emissions = 3.78 tons (1.17 tons (Transit) + 2.61 tons (Maneuvering))

> **Total Annual Emissions** = annual emissions – transit [1.17 tons/year] + annual emissions – maneuvering [2.61 tons/year]

Tables A-2 through A-39 provide the detailed calculations for each vessel engine during each of the construction, commissioning, and O&M periods with aggregate annual emissions provided in Table A-1.

2.2.3.2 Offshore Generators

Offshore generators would be used during both construction and operation. Generators are assumed to be used for commissioning of the OSSs during construction as well as for powering construction equipment such as air compressors and hydraulic hammers. During O&M, offshore generators are assumed to be used on the OSS platforms for regular testing and in case of the need for emergency power if the connection to the grid is lost. Offshore generators are assumed to operate at full load.

Emission factors for the generators are based on the assumption that the engines used meet the requirements of the highest available tier (i.e., Tier 4) from 40 CFR Part 1039 regulations. HAP emission factors for the generators are based on USEPA AP-42 emission factors for HAP emissions from internal combustion engines as found in AP-42 Chapters 3.3 (Engines <600 HP) and 3.4 (Engines>600 HP).

Engine sizes and anticipated hours of operation during construction were provided by US Wind. For the generators to be installed on each OSS during O&M, annual emissions are based on potential operation of 1,000 hours per year per generator. The emission factor was multiplied by the rated engine capacity and by the estimated number of operating hours per year to obtain annual emission estimates.

2.2.3.1 Switchgear

US Wind may use sulfur hexafluoride (SF-6) to insulate electrical equipment at each WTG and OSS, potentially resulting in fugitive greenhouse gas emissions from unexpected equipment leakage. Due to its extremely stable chemical properties, SF-6 is commonly used in electrical equipment to provide insulation for switchgear and to quench arcs. However, US Wind has not designed the electric requirements for the WTGs and OSSs and thus, the potential for SF-6 emission, if any, are currently unknown for this OCS air permit application. US Wind will request suppliers to assess the use of SF-6 alternatives, where such equipment would meet the safety and performance requirements of the supplied equipment. If the use of SF-6 alternatives would be technically and economically feasible for any supplied equipment. US Wind will file supplemental greenhouse gas emissions information regarding fugitive SF-6 emissions.

2.2.4 Annual Emission Summary – Construction, Commissioning, and O&M

Project air emissions during construction, commissioning, and O&M that are subject to permitting under 40 CFR Part 55 are summarized in Table 2-4. The estimate of the Project's potential air emissions during construction, and O&M is based on the Project parameters and emission units described in Sections 2.2.1 and 2.2.2 and the emission calculation methodology described in Section 2.2.3.

The estimate of the Project's potential air emissions was conducted assuming the use of the maximum design scenario associated with the Projects' PDE to ensure a reasonably conservative estimate of emission rates from the Project. It was conservatively assumed that the PDE could be constructed and operating within a 3 year period. The Project would be constructed in up to four campaigns; therefore, some portions of the wind farm would be under construction while other parts would be operational. Annual construction emissions reflect these overlapping periods by including O&M emissions for WTGs that have been commissioned and are operational while the remainder of the WTGs and OSSs are constructed and commissioned. The overlap of construction, commissioning, and O&M that may occur within years 2 and 3 of the construction and commissioning period is based on assumed construction of 21 WTGs in year 1, 55 WTGs in year 2, and 45 WTGs in year 3. This assumption provides a worst-case annual estimate of emissions as it assumes a condensed construction schedule within a three (3) year period. A preliminary construction schedule was provided in Section 2.0 and would occur over a four (4) year period.

Appendix A, Table A-1 provides detailed calculations of annual emissions during construction, commissioning and O&M. A detailed assessment of the Federal and State regulations based on the annual emissions is provided in Section 3.

Note that the air emission estimates provided in the Air Quality Modeling Protocol (Appendix B-3) were preliminary estimates that have been refined. The preliminary estimate of the

Project's potential air emissions was conducted assuming that all WTG positions, all OSSs, and the maximum length of inter-array, and offshore export cables would be installed, which represents the PDE. The emissions rates were based on BOEM Tool default emission factors and operational assumptions. For example, the vessels' main and auxiliary engines were assumed to operate 24 hours a day within 25 nautical miles of the Project, which is conservative and not how the vessels are expected to regularly operate during the construction campaigns. Additionally, these emission estimates did not take into consideration a regulatory control technology assessment (i.e., a BACT and LAER assessment) that is required. The emission estimates were updated to reflect refinements in the Project design and construction plan and to reflect more refined emission factors based on the results of the regulatory control technology assessments for vessel and auxiliary engine operations.

Table 2-1: Vessel Summary

Vessel Class	Vessel Role	Foundation	Offshore, Onshore, and Inter-array Cables	OSS	WTG	Support	Approx. Length	Approx. Displacement	Approx. Crew Size	Est. # of Fuel Tanks	Estimated Max Fuel Storage Capacity
Utility boat, Fishing Vessel	• Marine Mammal Observers • Environmental Monitors • Guard Vessels • Acoustic Monitoring	X		X		X	15 - 25 m (45 - 80 ft)	20 - 250 t	2 - 10	2 - 6	8,000 L (2,110 gal)
Fall Pipe	Installation of scour protection	X		X			120 - 170 m (400 - 550 ft)	15,000 - 25,000 t	20 - 60	10 - 20	260,000-1,800,000 L (68,680-475,510 gal)
Heavy Lift and General Cargo	Delivery of project components from manufacturing location to staging/assembly port	X	X	X	X		120 - 223 m (394 - 735 ft)	15,000 - 65,000 t	15 - 25	10 - 20	260,000-1,800,000 L (68,680-475,510 gal)
Jack-up Crane or Floating Crane	• Installation of project components • Foundation • WTGs • OSS	X		X	X		120 - 225 m (400 - 740 ft)	20,000 - 80,000 t	25 - 220	10 - 20	260,000-1,800,000 L (68,680-475,510 gal)
Multipurpose Offshore Supply	• Supply of materials and consumables	X	X	X	X	X	65 - 90 m (210 - 295 ft)	500 - 3,000 t	8 - 25	10 - 20	378,000 L (100,000 gal)

Vessel Class	Vessel Role	Foundation	Offshore, Onshore, and Inter-array Cables	OSS	WTG	Support	Approx. Length	Approx. Displacement	Approx. Crew Size	Est. # of Fuel Tanks	Estimated Max Fuel Storage Capacity
	• Pre lay grapnel run boulder clearance • Noise Mitigation • Foundation Grouting • Refueling • Cable Burial										
Anchor Handling	Anchor positioning for installation vessels	X		X			20 - 80 m (65 - 262 ft)	50 - 2,500 t	5 - 20	5 - 15	284,000 L (75,000 gal)
Crew Transfer Vessel	Crew Transfer	X	X	X	X	X	10 - 30 m (30 - 100 ft)	50 - 1,500 t	2 - 5	3 - 8	8,000 (2,110 gal)
Cargo Barge	Feeder Vessel: Delivering components from staging port to Project site	X		X	X		75 - 120 m (250 - 400 ft)	9,600 - 17,000 t	N/A		N/A
Tugs	Feeder Barge: Movement and general support	X		X	X	X	16 - 35 m (75 - 115 ft)	250 - 2000 t	5 - 10	3 - 8	215,000 L (56,800 gal)
Jack-up or Accommodation vessel	Housing for offshore workers during construction			X	X		55 - 100 m (180 - 328 ft)	750 - 5,000 t	50 - 200	8 - 12	215,000 L (56,800 gal)
Survey	Pre-Installation and Verification Surveys Geophysical and Geotechnical	X	X	X	X		13 - 112 m (45 - 350 ft)	400 - 3,000 t	5 - 70	5 - 12	8,000 – 52,000 L (2,110 – 13,800 gal)
Cable Laying	Cable Installation		X				80 - 150 m (262 - 492 ft)	1,200 - 1,5000 t	15 - 45	10 - 20	120,000 L (31,700 gal)

Vessel Class	Vessel Role	Foundation	Offshore, Onshore, and Inter-array Cables	OSS	WTG	Support	Approx. Length	Approx. Displacement	Approx. Crew Size	Est. # of Fuel Tanks	Estimated Max Fuel Storage Capacity
Rock/ Mattress Placement	Placement of Scour Protection, Concrete Mattresses		X				130 - 170 m (427 - 558 ft)	25,000 t	20 - 60	10 - 20	260,000-1,800,000 L (68,680-475,510 gal)
Dredging	Seabed preparation/ leveling			X			75 - 120 m (250 - 400 ft)	2,000 - 7,000 t	15 - 25	10 - 20	284,000 L (75,000 gal)
Service Operation	Commissioning Activities			X	X		80 m (262 ft)	5,500 t	20 - 50	8 - 12	284,000 L (75,000 gal)
Cable barge	In shore cable installation		X				30.5 m (100 ft)		2 - 4	1	3,785 L (1,000 gal)
Anchor handling tug	In shore cable installation		X				7.6 – 15 m (25 – 50 ft)		1 - 4	1 - 2	3,785 L (1,000 gal)

Table 2-2: Emission Source Descriptions

Emission Source	Purpose	Phase
Heavy lift crane vessels	Lift, support, and orient the components of each WTG and OSS during installation. Used for foundation installation.	Construction
Cable installation vessels	Lay and bury transmission cables in the seafloor.	Construction
Scour protection installation vessels	Deposit a layer of stone around the WTG and OSS foundations to prevent the removal of sediment by hydrodynamic forces. May place cable protection over limited sections of the offshore cable system.	Construction
Multipurpose offshore support vessels	Clear the seabed floor of debris prior to laying transmission cables.	Construction
Tugboats	Transport equipment and barges to the OCS source.	Construction and as needed, O&M
Anchor handling tug supply vessels	Install underwater noise mitigation devices (e.g., bubble curtains). Support offshore export cable installation.	Construction
Jack-up vessels	Transport WTG components to the WDA. Extend legs to the ocean floor to provide a safe, stable working platform used for offshore crew accommodation.	Construction and, as needed, O&M
Dredging vessels	Used in certain areas prior to cable laying to remove the upper portions of sand waves.	Construction
Survey vessels	Used to perform geophysical and geotechnical surveys.	Construction
Service operation vessels	Transport crew to the WDA. Provide offshore living accommodation and workspace.	Construction and, as needed, O&M
Ocean-Going Heavy Transport Vessels (HTV)	Ocean-going vessels that may transport components (e.g., monopiles) directly to the WDA.	Construction

Emission Source	Purpose	Phase
Offshore Substation Diesel Electric Generator	An OSS serves as the common interconnection point for the WTGs. The WTGs would interconnect with an OSS via a submarine cable system. Each OSS may have a diesel electric generator.	Construction and O&M

Table 2-3: BOEM Wind Tool Versions 1 and 2 Emission Factors

Engine Category	USEPA Tier	NO_X Factor (g/kw-hr)		PM2.5 Factor (g/kw-hr)	
		Wind Tool Version 1	Wind Tool Version 2	Wind Tool Version 1	Wind Tool Version 2
1 and 2	0	13.36	10.55	0.31	0.2036
	1	10.55		0.31	
	2	8.33		0.31	
	3	5.97		0.11	
3	0	14.7		0.42	
	1	14.7		0.42	
	2	14.7		0.42	
	3	14.7		0.42	

Table 2-4: Annual Emissions Summary (tons/year)

Year	NO_x	VOC	CO	PM10	PM2.5	SO_2	Pb	HAPs	H_2SO_4	CO_2	CH_4	N_2O	CO_2e
Construction and Commissioning Year 1	248.95	4.48	60.44	8.10	7.85	0.79	0.001	0.53	0.04	16,517.0	0.12	0.78	16,751.1
Operation Year 1	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.0	0.00	0.00	0.0
Year 1 Total	**248.95**	**4.48**	**60.44**	**8.10**	**7.85**	**0.79**	**0.001**	**0.53**	**0.04**	**16,517.0**	**0.12**	**0.78**	**16,751.1**
Construction and Commissioning Year 2	611.23	10.93	145.26	19.93	19.32	1.99	0.003	1.29	0.09	39,925.7	0.26	1.90	40,499.4
Operation Year 2	4.35	0.33	4.23	0.11	0.11	0.01	0.000	0.03	0.00	1,158.1	0.01	0.05	1,173.8
Year 2 Total	**615.58**	**11.25**	**149.48**	**20.04**	**19.43**	**2.00**	**0.003**	**1.33**	**0.09**	**41,083.8**	**0.27**	**1.95**	**41,673.3**
Construction and Commissioning Year 3	500.15	8.96	119.27	16.31	15.81	1.63	0.002	1.06	0.07	32,755.4	0.22	1.56	33,225.1
Operation Year 3	15.73	1.19	15.29	0.41	0.41	0.04	0.000	0.12	0.00	4,191.1	0.04	0.19	4,248.1
Year 3 Total	**515.88**	**10.15**	**134.56**	**16.72**	**16.22**	**1.68**	**0.003**	**1.18**	**0.08**	**36,946.5**	**0.26**	**1.75**	**37,473.2**
O&M	**25.05**	**1.89**	**24.34**	**0.66**	**0.65**	**0.07**	**0.000**	**0.18**	**0.00**	**6,672.6**	**0.06**	**0.30**	**6,763.4**

Notes: PM10 and PM2.5 account for both filterable and condensable fractions.

3.0 REGULATORY REQUIREMENTS

Section 328(a) of the Clean Air Act requires that USEPA establish air pollution control requirements for OCS sources located within 25 nautical miles of states' seaward boundaries that are the same as onshore requirements. This includes, but is not limited to, state and local requirements for emission controls, emission limitations, emission offsets, permitting, monitoring, testing, and reporting. The purpose of this requirement is to attain and maintain Federal and State ambient air quality standards. USEPA's OCS implementing regulations, found at 40 CFR Part 55, apply to all OCS sources offshore of the states except those located in certain areas of the Gulf of Mexico.

OCS sources located within 25 NM of a States' seaward boundaries are subject to the Federal requirements set forth in 40 CFR Part 55.13 and the Federal, State, and local requirements of the COA set forth in 40 CFR Part 55.14. Because the Project's WDA is located on the OCS within 25 NM of Maryland's seaward boundary, the Project is subject to the applicable requirements of the most current Maryland Air Regulations that are listed in Appendix A of the OCS Air Regulations. Notable federal, state, and local requirements of the COA incorporated by reference into 40 CFR Part 55.13 and 55.14 include NSPS, PSD review, and NNSR review.

3.1 Applicable Regulatory Requirements

3.1.1 New Source Performance Standards (NSPS)

Pursuant to 40 CFR Part 55.13(c), NSPS apply to OCS sources in the same manner as in the COA. Only the OCS source emissions, that is, stationary source activities, are subject to NSPS. This section discusses NSPS potentially applicable to the Project. The only NSPS category under 40 CFR Part 60 that applies to the Project's OCS sources is Subpart IIII —Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. A review of other NSPS finds none are applicable. As examples, US Wind expects no fired steam generating units subject to Subparts Db or Dc, no tanks holding organic liquids volatile enough to be subject to Subpart KKB, and no spark-ignition engines subject to Subpart JJJJ.

3.1.1.1 NSPS Requirements for Diesel Generators on OSS

Internal combustion engines (i.e., generating sets) located on an OSS are required to meet 40 CFR Part 60, Subpart IIII to the extent that the stationary source regulations are applicable. For the purposes of determining which emission limit is applicable to these internal combustion engines, the date that construction commences is the date the engine is ordered by the original owner or operator. For example, in the case of a diesel generator on an OSS, when US Wind begins construction of the Project, that date determines the operative date for the NSPS regulation.

Additional regulations that the NSPS references are the following operative regulations:

- 40 CFR Part 89 - Control of Emissions From New And In-Use Nonroad Compression-Ignition Engines [15]
- 40 CFR Part 1039 - Control of Emissions From New And In-Use Nonroad Compression-Ignition Engines [16]
- 40 CFR Part 1042 - Control of Emissions From New And In-Use Marine Compression-Ignition Engines And Vessels [17]

The NSPS subpart IIII regulation allows non-emergency engines being installed on marine offshore installations to meet the emission standards in either: Section 60.4201(a) or in Section 60.4201(f). Section 60.4201(a) requires Tier 4 standards for new non-emergency engines under Part 1039. Section 60.4201(f) requires applicable Tier standards from Part 1042 depending on the engine size and model year. Based on recent LAER determinations for offshore wind projects discussed in Section 4 and a review of the relevant regulations, the lowest emitting diesel-fired electric generators are generators certified to the highest Tier standard in 40 Part 1039 (i.e., Tier 4).

For the diesel-powered electric generators on the OSSs used during construction, commissioning, and operation, the expected standards are:

- Use of good combustion practices [18],
- Reduce idling where possible,
- Use of ultra-low sulfur distillate fuel; and
- Tier 4 engine emission requirements in 40 CFR Part 1039.

The engines must be certified by the manufacturer to meet or emit less than the Tier 4 emission standards set forth at 40 CFR Part 1039.101(b) for new compression-ignition engines (see Table 3-1). The emission limits for NO_x, VOC, CO and PM, would depend on the engine's maximum engine power (in kW).

The NSPS regulation for emergency engines allows for lower Tier emission standards. However, emergency engines subject to 40 Part 60, Subpart IIII must meet the operational limitations in Section 60.4211(f) which allows emergency engines to operate for up to 100 hours per calendar year for maintenance checks and readiness testing. Thus, if the engines would be operated for more than 50 hours a year for non-emergency purposes during commissioning/construction and/or operation, the engines would need to meet the non-

15 https://www.eC.F.R..gov/current/title-40/chapter-I/subchapter-C/part-89
16 https://www.eC.F.R..gov/current/title-40/chapter-I/subchapter-U/part-1039
17 https://www.eC.F.R..gov/current/title-40/chapter-I/subchapter-U/part-1042
18 Includes installing and operating the engines according to the most recent manufacturer recommendations and conducting regular maintenance.

emergency standards found in Section 60.4201. It is expected that the engines could be used for greater than 50 hours per year for non-emergency purposes and as such, would need to meet the non-emergency standards.

3.1.1.2 NSPS Requirements for Marine Vessels

Pursuant to 40 CFR part 55.13(c), the NSPS IIII standards would also apply to vessels that are regulated as OCS sources. Although NSPS typically applies only to stationary sources, the broad definition of OCS source contained in the OCS air regulations require that some marine vessel engines and non-road engines be subject to NSPS. The NSPS standards for compression ignition (CI) engines contained in 40 CFR Part 60, Subpart IIII would apply to the marine engines while the vessels are regulated as OCS sources.

These regulations set air emission standards for both emergency and non-emergency engines. The engines on vessels that would be used in the construction, commissioning, and O&M of this project include propulsion engines that would be used to power vessels as well as stationary engines used on equipment on the vessels, which typically would be only non-emergency engines.

The NSPS requirements and emission limitations are grouped by the following engine characteristics:

- Whether the engine is an emergency or non-emergency engine,
- Model year of the engine (date that construction commences is the date the engine is ordered by the owner/operator),
- Maximum power of the engine; and
- Displacement of the engine.

Applicable emission limits for marine engines depend on the size, age and maximum power of the engine and whether the engine is considered an emergency or non-emergency engine. The emission limits for marine engines are divided into different Tier standards, ranging from Tier 1, which allows the least stringent emissions, to Tier 4, associated with the most stringent emissions limitations. The manufacturer of Tier 2 and higher internal combustion engines would build into the engines' design, air pollution control technologies such as turbocharger, aftercooler, and high injection pressure, with a Tier 4 engine having the most air pollution control technologies built into its design. Compliance with tiered standards set forth in the regulations is assured through a certification process. Recently, USEPA harmonized the US regulations with those of MARPOL (the International Convention for the Prevention of Pollution from Ships). Major differences between the USEPA and MARPOL compliance requirements are: (1) USEPA liability for in-use compliance rests with the engine manufacturer (it is the vessel operator in MARPOL), (2) USEPA requires a durability demonstration (under MARPOL, compliance must be demonstrated only when the engine is installed in the vessel), and (3) certain test conditions and parameters.

Marine vessel regulations are structured so that the duty to comply rests primarily with the manufacturer. USEPA relied on testing information from engines equipped with specific technologies to establish the tiered emission standards for a variety of types of engines, recognizing considerations for safety specifically in the marine environment. The regulations were designed in such a way that manufacturers may use these anticipated technologies, or they may find better ways to meet emission standards over time. Manufacturers of diesel engines have typically met the standards with more careful control of intake air and fuel injection, with some exhaust gas recirculation, and under the regulations, owners are not required to retire their old engines, vehicles, or equipment. Long-term standards for many of these engines generally involve additional use of aftertreatment devices.

In the event that a vessel becomes an OCS source, any CI internal combustion engine that operates on that vessel while it is an OCS source would also become subject to NSPS Subpart IIII. Owners and operators of non-emergency stationary CI internal combustion engines are subject to the NSPS emission standards in 40 CFR Part 60.4204. Table 3-2 provides the emission standards that apply to Category 1 and 2 marine CI engines, non-emergency diesel generators, and nonroad engines with a displacement of less than 30 liters per cylinder (when they are OCS sources).

Per 40 CFR part 60.4201(f), if the Project's non-emergency CI internal combustion engines have a displacement of less than 10 liters per cylinder, they may be certified to the provisions of 40 CFR Part 1042 (if Table 1 to 40 CFR Part 1042.1 identifies 40 CFR Part 1042 as being applicable), because the engines would be used solely at a marine offshore installation.

The NSPS for non-emergency compression-ignition internal combustion engines with a displacement of less than 30 liters per cylinder, particularly for engines located at a marine offshore installation, are essentially equivalent to compliance with USEPA's nonroad compression-ignition engine emission standards at 40 CFR Part 1039 or USEPA's marine compression-ignition engine standards at 40 CFR Part 1042. The only NSPS that does not cross reference USEPA's nonroad or marine compression ignition standards is for engines with a model year earlier than 2007 and a displacement of less than 10 liters per cylinder.

Tables 3-1 through 3-3 provides summaries of the applicable NSPS emissions standards by engines size, age, and displacement.

3.1.2 National Emissions Standards for Hazardous Air Pollutants (NESHAPs)

Per 40 CFR Part 52.13(e), NESHAPs apply to OCS sources if rationally related to the attainment and maintenance of Federal or State ambient air quality standards or the requirements of Part C of Title I of the Act. The only NESHAPs category under 40 CFR Part 63 that applies to the Project's OCS sources is Subpart ZZZZ, the NESHAP for Reciprocating Internal Combustion Engines (RICE).

For engine models 2006 and newer, compliance with the relevant NSPS Subpart IIII standards (above) constitute compliance with NESHAP Subpart ZZZZ at an area source (the Project is an area source of HAPs). Engines models older than 2006 at OCS sources are exempt from numerical emissions limits but have maintenance and fuel requirements per 40 CFR Part 63.6603 and 40 CFR Part 63.6604.

3.1.3 Other Federal and International Regulations for Marine Engines

Additional federal and international regulations govern emissions from marine diesel engines installed on U.S.-flagged and foreign-flagged vessels. Regulations potentially applicable to the Project include the following:

MARPOL Annex VI

The Project would utilize several vessels ranging in size and with a variety of purposes. Some vessels with be U.S.-flagged and some would be foreign-flagged. The MARPOL treaty, set forth by the International Maritime Organization, is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The U. S. is a signatory of the MARPOL treaty and has implemented it through 40 CFR Part 1043. Annex VI of the MARPOL treaty addresses air pollution prevention requirements. It contains limits on NO_x emissions and limits on fuel sulfur contents which reduces SO_2 and PM emissions. The MARPOL provisions apply to both U.S.- flagged and foreign-flagged vessels operating within U.S. waters.

The NOx emission limits set by Annex VI are presented in Table 3-4. The NOx emission limits of Annex VI apply to installed marine diesel engines, both main and auxiliary, of over 130 kW output power other than those used solely for emergency purposes which are installed on a ship constructed, or which undergo major conversion, on or after January 1, 2000. ‘Installed’ and ‘marine diesel engine’ are defined within MARPOL. The Tier III emission limits only apply to ships while operating within defined Emission Control Areas (ECA); outside such areas Tier II emission limits apply. The Project area is located within the North American Emission Control Area; therefore, foreign-flagged and U.S.-flagged vessels utilized by the Project must comply with Tier III emission limits if the ship is constructed on or after January 1, 2016.

The fuel oil sulfur limit which applies to the Project because the Project is within the North American Emission Control Area and would occur after January 1, 2015, is 0.1%, or 1000 parts per million (ppm).

40 CFR Part 80 – Regulation of Fuels and Fuel Additives

The requirements of 40 CFR Part 80 relevant to marine diesel fuel have been moved to 40 CFR Part 1090 as part of the Fuels Regulatory Streamlining action published in the Federal Register December 4, 2020.

40 CFR Part 89 – Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines

Per 40 CFR Part 89.1, USEPA has migrated the Tier 1, Tier 2, and Tier 3 engine standards originally promulgated in Part 89 to Part 1039 with additional testing and compliance provisions in Parts 1065 and 1068. If the Project utilizes engines originally certified under Part 89, the engines must continue to comply with applicable requirements of Part 89 as described in Part 1039.1.

40 CFR Part 94 – Control of Emissions from Marine Compression-Ignition Engines

Per 40 CFR Part 94.1, USEPA has migrated engine standards for engines with a model year of 2004 or later to Part 1042, with additional testing and compliance provisions in Parts 1065 and 1068. If the Project utilizes engines originally certified under Part 94, the engines must continue to comply with applicable requirements of Part 94 as described in Part 1042.1.

40 CFR Part 1039 – Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines

Applicable to all new compression-ignition nonroad engines unless exempted under 40 CFR Part 1039.5. New nonroad engines are defined under 40 CFR Part 1039.801. Part 1039 sets emission standards and other requirements for nonroad engines. Part 1039 may be applicable to Project engines when considered OCS sources.

40 CFR Part 1042 – Control of Emissions from New and In-Use Marine Compression-Ignition Engines and Vessels.

Applicable to all new compression-ignition marine engines on U.S.-flagged vessels and U.S.-flagged vessels containing such engines. The definition of 'new engine' and 'new vessel' is provided in 40 CFR Part 1042.901. Per 40 CFR Part 1042.2, requirements of Part 1042 are generally addressed to engine manufacturers other than requirements in Subpart I which addresses remanufactured marine engines. Part 1042 contains emission standards for Category 1, Category 2, and Category 3 marine engines. Per Part 1042.901, a Category 1 marine engine is a marine engine with a specific engine displacement below 7.0 liters per cylinder. A Category 2 marine engine has a specific engine displacement at or above 7.0 liters per cylinder but less than 30.0 liters per cylinder. A Category 3 engine has a specific engine displacement at or above 30.0 liters per cylinder.

40 CFR Part 1043 – Control of NO_x, SO_x, and PM Emissions from Marine Engines and Vessels Subject to the MARPOL Protocol.

Applicable to all U.S.-flagged vessels utilized for the Project unless the vessel contains no engines with a specific engine displacement at or above 30.0 liters per cylinder, the vessel operates only domestically and all compression-ignition engines on the vessel fully conform to all applicable provisions of 40 CFR Parts 94 and 1042. Also applicable to foreign-flagged vessels utilized for the Project, including vessels flagged by a country that is not a party to MARPOL Annex VI. The requirements of 40 CFR Part 1043 include obtaining an Engine International Air Pollution Prevention (EIAPP) certificate for certain engines, the NO_x emission limits and fuel sulfur contents of MARPOL Annex VI, and various recordkeeping and reporting obligations.

Because U.S.-flagged ships must comply with both MARPOL Annex VI and with applicable U.S. federal air pollution control rules, the USEPA published a document describing how these regulations interact[19]. One significant difference is that MARPOL Annex VI requires that vessel operators be responsible for ensuring the vessel meets the air pollution control requirements of MARPOL Annex VI while USEPA requires that vessel manufacturers be responsible for ensuring vessels comply with applicable air pollution control requirements for the full useful life of the vessel.

40 CFR Part 1090 – Regulation of Fuels, Fuel Additives, and Blendstocks

40 CFR Part 1090 specifies fuel quality standards for gasoline and diesel fuel introduced into commerce in the U.S. and requires that all diesel fuel has a maximum sulfur content of 15 ppm unless specifically exempted by 40 CFR Part 1090.300(a). 40 CFR Part 1090.325 sets sulfur standards that apply to any person who produces or handles Emission Control Area (ECA) marine fuel which is fuel used in marine vessels within designated ECAs as specified by MARPOL Annex VI. "ECA marine fuel" is defined in 40 CFR Part 1090.325 as *diesel, distillate, or residual fuel used, intended for use, or made available for use in C3 marine vessels while the vessels are operating within an ECA, or an ECA associated area*. "C3 marine vessel" is defined as *a vessel that is propelled by an engine(s) that meets the definition of "Category 3" in 40 CFR* Part *1042.901*. "Category 3" is defined in 40 CFR Part 1042.901 as *a reciprocating marine engine with a specific engine displacement at or above 30.0 liters per cylinder.*

40 CFR Part 1090.325 requires that ECA marine fuel must have a maximum sulfur content of 1,000 ppm unless the fuel meets exceptions of 40 CFR Part 1090.325(c). The first exception listed is for residual fuel for use in a steamship or C3 marine vessel if the U.S. government exempts the vessel from MARPOL Annex VI fuel standards; diesel fuel and other distillate fuel used in diesel engines operated on such vessels must comply with the sulfur content limit of

[19] US Environmental Protection Agency (EPA). 2002. Emission Standards for New Marine Diesel Engines. Relationship Between EPA's Control Program and MARPOL Annex VI. Retrieved November 8, 2021, from https://nepis.epa.gov/Exe/ZyPDF.cgi/P1009YZS.PDF?Dockey=P1009YZS.PDF.

1,000 ppm. 40 CFR Part 1043.55 permits the use of fuels not meeting the fuel sulfur requirements of Annex VI provided approval is requested for U.S.-flagged vessels or the Administration of a foreign-flagged vessel certifies the vessel is equipped with controls achieving emission levels equivalent to those achieved using fuels meeting the applicable fuel sulfur limits of Annex VI.

Therefore, unless residual fuel usage is considered exempt from the U.S. government from MARPOL Annex VI standards, it must meet the maximum sulfur content limit of 1,000 ppm.

3.1.4 Maryland Requirements

Under the OCS Air Regulations, OCS sources are subject to the federal, state, and local requirements of the COA set forth in 40 CFR Part 55.14. In the Project's Notice of Intent (NOI), US Wind identified Maryland as the NOA to the Project Area. The Maryland regulations have been incorporated into 40 CFR Part 55 by reference and are listed in Appendix A of the OCS Air Regulations. In accordance with 40 CFR 55.4, the USEPA has delegated the MDE authority to implement 40 CFR 55 which requires new OCS stationary sources to obtain a permit from MDE prior to commencing construction. Per 40 CFR Part 55.11(b), that delegation occurred when Maryland demonstrated that the State has adopted the appropriate portions of the regulation into State law, and has adequate authority, resources, and administrative procedures to implement the regulation.

3.1.4.1 Generally Applicable Chapters

Several of the chapters of Maryland's air quality regulations are generally applicable to all sources, mainly containing administrative provisions and procedures. The provisions of the following chapters of COMAR 26.11 are generally applicable to the Project:

- Chapter 1 – General Administrative Provisions;
- Chapter 2 – Permits, Approvals, and Registration;
- Chapter 3 – Permits, Approvals, and Registration – Title V Permits;
- Chapter 20 – Mobile Sources; and
- Chapter 22 – Vehicle Emissions Inspection.

Chapter 1 provides term definitions, general testing and monitoring, general record-keeping, opacity, and emission statement requirements. The Project is located in Area VI, provided that the COA is Worcester County. The MDE requires an emissions statement for the previous calendar year that meets the requirements of this regulation for facilities in Worcester County with VOC emissions of 50 tons and/or NO_x emissions of 100 tons per year or more. US Wind will submit annual emissions statements as required.

Chapter 2 provides term definitions, permitting requirements and procedures, and fees. The MDE requires certain sources to obtain a preconstruction air quality permit known as a Permit to Construct per COMAR 26.11.02.09. The Project is required to obtain a Permit to Construct because it is subject to major source NSR and PSD review.

Chapter 3 provides air permit application and content requirements for major source Title V facilities. This Chapter also provides source exemptions, public participation procedures, and administrative review and hearing procedures for USEPA and the public. As shown in Table 3-5, potential emissions of regulated pollutants are above the Title V major source thresholds. As such, the facility is subject to Title V permitting requirements for these pollutants and is required to obtain a Title V Operating Permit per COMAR 26.11.03.01.

Chapter 20 provides requirements for ships and motor vehicles, including heavy duty diesel vehicles. Per COMAR 26.11.20.01, vessel emissions are subject to visible emissions standards using either maximum opacity standards or the Ringelmann smoke chart. US Wind will adhere to the vessel opacity provisions of the regulation.

Chapter 22 provides motor vehicle emissions inspection requirements that have been jointly adopted by the Maryland Motor Vehicle Administration and the MDE. US Wind will not utilize motor vehicles as this is a marine Project on the OCS. As such, this Chapter is not applicable to the OCS air permit application.

3.1.4.2 Chapter 4 – Ambient Air Quality Standards

COMAR 26.11.04 – *Ambient Air Quality Standards* establishes a state ambient air quality for fluorides and adopts the federal NAAQS. In addition to the federal NAAQS, Maryland has promulgated state-specific ambient air quality standards (SAAQS) in COMAR 26.11.04. The only SAAQS that exists in addition to the NAAQS is for fluorides. Emissions of fluorides from the Project are not expected and, as such, a SAAQS demonstrations is not required. US Wind would comply with the federal NAAQS provisions which are incorporated by reference into the Maryland regulations by COMAR 26.11.04.02.

3.1.4.3 Chapter 5 – Air Pollution Episode System

COMAR 26.11.05 – *Air Pollution Episode System* establishes the requirements for development and operation under an air pollution episode system which is designed to provide standards and procedures to be followed whenever pollution of the air has the potential of reaching an emergency condition if allowed to go unchecked. The provisions of COMAR 26.11.05 are applicable at the discretion of the MDE. US Wind does not anticipate that MDE would require an air pollution episode system.

3.1.4.4 Chapter 6 – General Emission Standards, Prohibitions, and Restrictions

COMAR 26.11.06 – *General Emission Standards, Prohibitions, and Restrictions* establishes emission standards for various pollutants from certain source types. Sections of COMAR 26.11.06 which are potentially applicable to the Project are discussed below.

- **Visible Emissions.** COMAR 26.11.06.02 establishes visible emission limits for source categories which are not exempted per COMAR 26.11.06.02(A)(1). The vessels and OSS engines, while regulated as stationary sources, are required to comply with COMAR 26.11.09.05, which takes precedence over these requirements per COMAR 26.11.09.02(A).

- **Carbon Monoxide (Not Applicable).** COMAR 26.11.06.04 establishes CO emission limits for sources in Areas III and IV. Per COMAR 26.11.01.03(F), Worcester County is located in Area VI. As such, the CO limits do not apply to the Project.

- **Sulfur Compounds (Not Applicable).** COMAR 26.11.06.05 establishes limits for emissions of sulfur compounds from sources which are not fuel burning equipment. The Project emissions sources meet the definition of fuel burning equipment and as such, COMAR 26.11.06.05 is not applicable.

- **Volatile Organic Compounds (Not Applicable).** COMAR 26.11.06.06 establishes control standards for VOC from sources which are not fuel burning equipment. The Project sources are fuel burning equipment, and such these sources are exempt from these requirements per COMAR 26.11.06.06(A)(1)(c).

- **Nuisance and Odors.** COMAR 26.11.06.08 and COMAR 26.11.06.09 establish general provisions for the control of nuisances and odor, respectively. The Project would be subject to these general requirements.

- **NSPS Sources.** COMAR 26.11.06.12 incorporates by reference into the federal NSPS regulations codified in 40 CFR Part 60. Applicability of NSPS regulations is discussed in Section 3.4.

- **PSD Sources.** COMAR 26.11.06.14 incorporates by reference the federal PSD permitting regulations codified in 40 CFR Part 52.21. Applicability of PSD permitting is discussed in Section 3.2.

3.1.4.5 Chapter 9 – Fuel Burning Equipment

COMAR 26.11.09 – *Control of Fuel-Burning Equipment, Stationary Internal Combustion Engines, and Certain Fuel- Burning Installations* establishes emission limits for various pollutants from certain types of fuel burning units. The engines on the vessels and OSSs while regulated as stationary OCS sources would meet the definition of fuel burning equipment and are subject to the requirements of this chapter. Sections of COMAR 26.11.09 which are applicable to the Project are discussed below.

- **Visible Emissions.** COMAR 26.11.09.05 establishes visible emissions limits for fuel burning equipment. The fuel burning equipment in the Project would need to comply with the visible emissions limits under this regulation. Internal combustion engines while regulated as stationary OCS sources would be subject to COMAR 26.11.09.05(E) which limits visible emissions to 10 percent when operating at idle and to 40 percent when operating at conditions other than idle. These limits do not apply while maintenance, repair or testing is being performed by qualified mechanics. The 10 percent limit for idling does not apply for a period of two consecutive minutes after a period of idling 15 consecutive minutes for the purpose of clearing the exhaust system. The 10 percent limit also does not apply to emissions resulting directly from cold engine start-up and warm-up for a maximum of 30 minutes if engine is idled continuously when not in service or a maximum of 15 minutes for all other engines.

- **Particulate Matter (Not Applicable).** COMAR 26.11.09.06 establishes limits for PM emissions from fuel burning equipment. For new fuel burning equipment in Area VI, PM emission limits are established for fuel burning equipment combusting solid fuel or residual oil. No Project emission units while they are considered as stationary OCS sources would burn these fuels. Additionally, per COMAR 26.11.09.06(b), fuel burning equipment on vessels are exempt from this regulation. As such, there are no applicable PM limits to the Project.

- **Sulfur Oxides.** COMAR 26.11.09.07 establishes limits for sulfur oxides emissions from fuel burning equipment. US Wind would comply with a limit of 0.3 percent sulfur content in diesel fuel burned in the engines while they are considered as stationary OCS sources per COMAR 26.11.09.07(A)(1)(c). Additionally, per COMAR 26.11.09.07(1)(B)(2), fuel burning equipment on vessels are exempt from this regulation. As such, there are no applicable fuel sulfur restriction on the vessel engines while they are not regulated as stationary OCS sources.

- **Nitrogen Oxides.** COMAR 26.11.09.08 establishes limits for NO_x emissions from fuel burning equipment located at major stationary sources of NO_x (i.e., sources with potential emissions more than 100 tpy of NO_x, located in Worcester County). The engines on the OSSs are considered as stationary OCS sources, would be required to comply with a COMAR 26.11.09.08(E). US Wind would also be required to comply with the operator training and annual combustion analyses requirements.

3.1.4.6 Chapter 13 – Gasoline and VOC Storage and Handling

COMAR 26.11.13 – *Control of Gasoline and Volatile Organic Compound Storage and Handling* establishes work practice standards for various activities related to the storage and handling of gasoline and VOCs. US Wind would not be storing or handling gasoline or VOCs, and thus this Chapter is not applicable.

3.1.4.7 Chapters 15 and 16 – Toxic Air Pollutants

COMAR 26.11.15-16 – *Toxic Air Pollutants* and *Procedures Related to Requirements for Toxic Air Pollutants* establish MDE's program for toxic air pollutants (TAPs). The air toxics emissions from the Project would be from fuel burning equipment, which are exempt from the state toxics requirements, as codified in 26 COMAR 11.15.03(B)(2)(a).

3.1.4.8 Chapter 17 – Nonattainment New Source Review

COMAR 26.11.17 – *Nonattainment Provisions for Major New Sources and Major Modifications* establishes Maryland's NNSR permitting program. The applicability of NNSR to the Project is discussed in Section 3.2.

3.1.4.9 Chapter 19 – Volatile Organic Compounds (Not Applicable)

COMAR 26.11.19 – *Volatile Organic Compounds from Specific Processes* establishes emission limits for VOCs from various processes. The Project does not include the installation of any process sources and as such, this regulation is not applicable.

3.2 Air Quality Permit Requirements

3.2.1 Title V Operating Permit and State Preconstruction and Operating Permit Programs

The Title V permit program in 40 CFR Part 70 requires major sources of air pollutants to obtain federal operating permits. The major source thresholds under the Title V program, as defined in 40 CFR 70.2 and which are different from the federal NSR major source thresholds, are 100 tpy of any air pollutant, 10 tpy of any single hazardous air pollutant (HAP), or 25 tpy of total HAPs. More stringent Title V major source thresholds apply for VOC and NO_x in ozone nonattainment areas, namely 50 tpy of VOC or NO_x in areas defined as serious, 25 tpy in areas defined as severe, and 10 tpy in areas classified as extreme. For Title V applicability, the major source thresholds for NO_x and VOC are 100 and 50 tpy, respectively in Worcester County per COMAR 26.11.03.01.

Maryland's Title V Operating Permit Program is administered through a USEPA-approved program at COMAR 26.11.03. MDE also administers a state operating permit program through COMAR 26.11.02.13 for certain non-Title V facilities. As shown in Table 3-5, potential emissions of regulated pollutants are above the Title V major source thresholds. As such, the facility is subject to Title V permitting requirements for these pollutants and is required to obtain a Title V Operating Permit per COMAR 26.11.03.01.

The MDE requires certain sources to obtain a preconstruction air quality permit known as a Permit to Construct per COMAR 26.11.02.09. The Project is required to obtain a Permit to Construct because it is subject to major source NSR and PSD review. Thus, this application for a permit to construct per COMAR 26.11.02 includes the relevant MDE application forms in Appendix C.

3.2.2 Maryland Enhanced Public Participation Requirements

3.2.2.1 Local Zoning Approval

The MDE determined that the OCS air permit application is subject to expanded public participation. These procedures are stated in COMAR 26.11.02.11. As part of the expanded public participation process, permit applicants are required to provide evidence of zoning approval for their proposed project. Maryland Environment Article, §2–404(b)(1) states "before accepting an application for a permit subject to subsection (c) of this section, the Department shall require the applicant to submit documentation: (i) That demonstrates that the proposal has been approved by the local jurisdiction for all zoning and land use requirements; or (ii) That the source meets all applicable zoning and land use requirements." In accordance with Maryland Environment Article, §2–404(b)(1), US Wind is providing documentation in Appendix D that demonstrates compliance with the MDE regulation.

3.2.2.2 Environmental Justice

As part of the expanded public participation process, US Wind is required to complete and present an "MDE Screening Report and Environmental Justice (EJ) Score." As of October 1, 2022, all public review permit to construct applications require an MDE Screening Report and EJ Score, in accordance with HB 1200/Ch. 588 of 2022. The EJ Score is based on the census tract in which the Project is located using the Maryland EJ mapping tool. The EJ Score is expressed as a statewide percentile and considers four indicators to identify overburdened and underserved communities: pollution burden exposure, pollution burden environmental effects, sensitive populations, and socioeconomic/demographic data. Provided that this is Project is located on the OCS, the MDE has determined that the nearest census tract to the Project location is the geographical basis for the EJ mapping tool.

The concept behind the term EJ is that regardless of race, color, national origin, or income, all Maryland residents and communities should have an equal opportunity to enjoy an enhanced quality of life. The Maryland General Assembly passed HB 1200, effective October 1, 2022, that adds to MDE's work incorporating diversity, equity and inclusion to help overburdened and underserved communities with environmental issues. In accordance with HB 1200/Ch. 588 of 2022, US Wind is providing in Appendix D, an EJ Score for the census tract that is nearest to the Project location using the Maryland EJ mapping tool (i.e., Census Tract Census Tract 9501,Worcester County). The EJ Score, expressed as a statewide percentile, was shown to be 17.29. This score considers three demographic indicators – minority population above 50%, poverty rate above 25% and limited English proficiency above 15%. To account for other sources of pollution surrounding the proposed source, US Wind conducted an additional EJ Score analysis to evaluate the impact of other sources located nearest the shoreline within Worcester County. The highest EJ Score for census tracts located within the Worcester County Shoreline (i.e., census tracts located within 1 mile of the shore), expressed as a statewide percentile, was shown to be 22.15.

An EJ Score of 22.15 indicates that the proposed installation is located in an area that is not disproportionately impacted by sources of pollution or at a higher risk of health problems from environmental exposures than other areas in Maryland.

3.3 PSD Program Requirements

3.3.1 Attainment Status

The USEPA has established NAAQS for each of the following criteria air pollutants: PM10, PM2.5, SO_2, ozone (O_3), NO_2, CO, and Pb. Areas in which the NAAQS are being met are referred to as attainment areas. Areas in which the NAAQS are not being met are referred to as non-attainment areas. Areas that were formerly non-attainment areas but are now in attainment and covered by a maintenance plan are referred to as maintenance areas. Areas for which sufficient data are not available to determine a classification are referred to as unclassifiable. The federal attainment status designations of areas in Maryland with respect to NAAQS are listed at 40 CFR Part 81.321. Worcester County is in Eastern Shore Intrastate Air Quality Control Region (AQCR) 114.

The COA is in an area currently designated as attainment for SO_2, NO_2, CO, PM10, PM2.5, and ozone. Worcester County, however, is located in the ozone transport region, and under this designation for 8-hour ozone, new facilities with emission increases of more than 100 tons per year of NO_x and/or more than 50 tons per year of VOC, respectively, are subject to NNSR for these pollutants.

3.3.2 PSD Review Requirements

The PSD Program, as set forth in 40 CFR Part 52.21 is incorporated by reference into the OCS Air Regulations in 40 CFR 55.13(d). PSD applies to OCS sources located within 25 NM of a State's seaward boundary if the PSD requirements are in effect in the corresponding onshore area. Per 40 CFR Part 52, Subpart W, the PSD program is in effect in Maryland. MDE has adopted the federal PSD permitting program in Code of Maryland Regulations (COMAR) 26.11.06.14.

The PSD program applies to new major sources of criteria pollutants or major modifications to existing sources in areas designated as being in attainment with or unclassifiable with the ambient air quality standards. Certain categories of stationary sources listed in 40 CFR 55.21(b)(1)(i)(a) are considered "major" if the source emits or has the potential to emit (PTE) 100 tons per year or more of a "NSR regulated pollutant as" defined in 40 CFR Part 52.21(b)(50). All other stationary sources are considered "major" if it emits or has a PTE of 250 tpy or more of a regulated NSR pollutant. The Project does not fall under any of the stationary source categories listed under 40 CFR 55.21(b)(1)(i)(a), therefore, the 250 tpy of NSR pollutant threshold applies.

"Potential to emit" is defined as the maximum capacity of a source to emit a pollutant under its physical and operational design (see 40 CFR Part 52.21(b)(4)). As noted, 40 CFR Part 55 defines "potential emissions" from OCS sources similarly. Typically, emissions from mobile sources and secondary emissions do not count when determining a stationary source's potential to emit for the purposes of PSD review. Secondary emissions are defined as emissions resulting from the construction or operation of a major stationary source that do not come directly from the major stationary source as (40 CFR 52.21(b)(18)). However, the broad definition of "OCS source" provided in the OCS Air Regulations requires certain construction equipment and vessels to be included in the "potential to emit" of an OCS source for PSD review.

The Project's potential air emissions during construction exceed the 250 tpy PSD threshold. Consequently, the Project is subject to PSD review. Thus, PSD regulations apply to each criteria pollutant that is emitted in excess of a defined Significant Emission Rate. Further, if GHG emissions expressed as carbon dioxide ("CO_2") equivalent (or "CO_2e") are greater than 75,000 tpy for a project that is a new major stationary source for a regulated NSR pollutant that is not GHGs, then GHGs are also included as a PSD pollutant. Once a single pollutant triggers PSD major status, the PTE of each remaining pollutant is compared against the SER threshold defined in 40 CFR Part 52.21(b)(23)(i) to determine whether the pollutant is required to undergo PSD review. Table 3-5 presents a PSD major source threshold analysis for the Project for those pollutants with applicable PSD emission criteria.

Facilities subject to PSD must perform an air quality analysis (which includes atmospheric dispersion modeling) and a BACT demonstration for those pollutants that exceed the pollutant specific Significant Project Thresholds identified in the regulations.

Dispersion modeling for the PSD requirements consists of three analyses: a significance analysis, a NAAQS analysis, and a PSD increment analysis. The significance analysis compares the maximum-modeled ambient concentrations from the proposed facility to the significant impact levels (SILs) listed in Table 3-6 for each pollutant. If the modeled concentrations for the proposed facility are less than the SILs, then more detailed NAAQS and PSD increment analyses are not required under PSD regulations. However, if the modeled concentrations are greater than the SILs, then NAAQS and PSD increment analyses are required for that pollutant. The NAAQS and PSD increments are listed in Table 3-7.

In order to facilitate this analysis, USEPA historically has relied upon SILs that represent thresholds of insignificant, i.e., de minimis, modeled source impacts. The SILs are intended to be small fractions of the NAAQS and PSD increment. USEPA has recommended specific SILs for comparison to the NAAQS and a separate set of recommended SILs for comparison to the PSD Increments. The PSD increment SILs are different for Class I, II and III areas. There are no Class I PSD Increment SILs for CO or GHG's, or for 1-hour NO_2. Exceeding the PSD Increment SIL would require the Project to perform a cumulative source analysis which would account for any sources that have consumed the PSD increment within the significant impact area.

In summary, the pollutants that exceed the applicable PSD SERs are CO, PM10, and PM2.5. Therefore, PSD requirements will be addressed for emissions of these pollutants in this application. All other NSR regulated pollutants are not subject to PSD as they are either below the PSD SERs or subject to NNSR review, and therefore are not subject to the PSD program requirements above. Sections 4 and 5 provide the PSD program analyses.

3.3.3 Preconstruction Ambient Air Quality Monitoring Exemption

As discussed previously, the PSD regulations require an applicant to perform an air quality analysis for those criteria pollutants emitted in quantities exceeding the SERs (and for which there are NAAQS) shown in Table 3-8. This analysis can include the collection of up to one year of ambient air quality monitoring data.

Pursuant to the PSD regulations, MDE may exempt a proposed PSD source, otherwise subject to the one-year pre-construction ambient monitoring requirement, if existing quality assured ambient air quality data are available from alternate locations that are representative of, or conservative, as compared to conditions at the proposed facility location.

A preconstruction monitoring exemption is discussed in Section 5.1.1 because US Wind is utilizing existing quality assured ambient air quality data from locations that are representative of conditions at the proposed Project site. US Wind is requesting a waiver from the requirement to perform pre-application ambient air quality monitoring for CO, NO_2, PM10, and PM2.5 because there exists acceptable quality assured ambient air quality data from alternate locations that satisfy the requirements of 40 CFR 52.21.1670. Further, US Wind is requesting an exemption from the requirement to perform pre-application ambient monitoring for SO_2 and lead because they will be emitted in amounts less than the SERs; for fluorides, hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds because they are not anticipated to be emitted from the Project; and for H_2SO_4 because there is no approved monitoring technique available.

3.3.4 Impacts on Class I Areas

There is one (1) Class I area within 300 km of the Project: The Brigantine Wilderness area located in the Edwin B. Forsythe National Wildlife Refuge (NWR) in New Jersey, approximately 126 kilometers northeast of the Project. The Federal Land Manager (FLM) for this Class I area has been notified by letter and requested to determine if assessments of impacts in the Class I areas would be required. Copies the letter are included in the agency correspondence in Appendix B-4.

3.4 NNSR Program Requirements

MDE has adopted NNSR permitting requirements for nonattainment areas in Title 26, Subtitle 11, Chapter 17 of COMAR. NNSR permitting may apply to facilities located in areas that are designated in 40 CFR Part 81 as not in attainment with the NAAQS for a specific criteria pollutant. As discussed in Section 3.3, Worcester County, is located in the ozone transport region, and under this designation for 8-hour ozone, new facilities with emission increases of more than 100 tons per year of NO_x and/or more than 50 tons per year of VOC, respectively, are subject to NNSR for these pollutants and require the application of LAER controls and emission offset requirements. The NNSR thresholds and major source threshold analysis are provided in Table 3-8. (Note that since NO_x and VOC are precursors to ozone formation, NO_x and VOC emissions would be controlled to the more stringent LAER emission levels if they exceed the NNSR thresholds).

As the Project triggers NNSR for Ozone with potential emissions above the NO_x NNSR threshold, the Project triggers a requirement for NO_x offsets, therefore no modeling is required for ozone.

3.4.1 Emission Offsets

A major source planned in a USEPA designated non-attainment or ozone transport area must obtain emissions reductions as a condition for approval. The emissions reductions, generally obtained from existing sources located in the vicinity of a proposed source, must offset the emissions increase from the new source or modification. These offsets, obtained from existing sources that implement a permanent, enforceable, quantifiable and surplus emissions reduction, must equal the emissions increase from the new source or modification multiplied by the offset ratios established in COMAR 26.11.17.03. For the Project, the required offset ratio for NO_x emissions is 1.15:1.

In accordance with COMAR 26.11.17.03 and MDE guidance[20], proposed major NNSR Projects located in an attainment area of the state within the ozone transport region may obtain emission offsets NO_x from any location within the ozone transport region. These offsets may also be obtained from another state in the ozone transport region, provided that an interstate reciprocal trading agreement is in place. The MDE requires that an applicant either own or have an option to purchase specific offsets prior to commencement of construction as discussed below:

> *Possession of the offsets are not required before a permit is issued. However, the permittee must either purchase the offsets outright or own the option to buy the ERCs prior to the commencement of construction. If the option to buy is in effect, it must be exercised prior to the commencement of operation of the affected unit(s). Further, documentation regarding the status of the offsets requirement must be submitted to MDE before commencing construction.*

The Project is located in an ozone transport region and would be required to purchase offsets from a source (or sources) located in the ozone transport region. Prior to commencing construction, each emission source providing offsets would be identified along with the proposed mechanism to affect the emission reduction. After the sources of the emission offsets are identified, the offsets would need to be transferred pursuant to the requirements of MDE and USEPA. Offsets may be created from past or future facility shutdowns, emission unit shutdowns or other reduction mechanisms acceptable to MDE.

MDE maintains a registry[21] of emission reduction credits for sources that have fulfilled the requirements for certifying emission reduction credits through enforceable permit modifications. This registry may be utilized in identifying such offsets. As of July 25, 2022, which is the most recent update from MDE, the offsets registry reported more than 1,272 tons of NO_x offsets within Maryland. In addition, the NJDEP maintains a registry[22] of emission reduction credits, which currently lists 847 tons of NO_x offsets for the southern New Jersey ozone non-attainment area.

Emission offsets are not required for project construction and commissioning emissions based on recent USEPA determinations for OCS air permits. As discussed in the July 11, 2022, Fact Sheet for Vineyard Wind, OCS-R1-03-M1[23], the USEPA concludes the following determination for emission offsets from OCS sources during construction.

> *In the May 19, 2021, initial permit for Vineyard Wind 1, USEPA included a requirement to obtain nitrogen oxide (NO_X) and volatile organic compound (VOC) emission offsets for construction emissions. In doing so, USEPA followed an approach it had applied in*

[20] https://mde.maryland.gov/programs/permits/AirManagementPermits/Documents/ERC-faqs-2017.pdf
[21] https://mde.maryland.gov/programs/permits/AirManagementPermits/Pages/Availble-ERCs.aspx
[22] https://dep.nj.gov/wp-content/uploads/boss/southern-last5years-cers.pdf
[23] https://www.epa.gov/system/files/documents/2022-07/fs-mod-vineyard-wind-1-wind-farm-ocs-air-permit.pdf

the first OCS permit EPA issued for a wind farm in 2011. In the fact sheet for the Vineyard Wind 1 permit, USEPA stated that based on construction and operations emissions, "the … facility's potential emissions exceed the permit applicability threshold for … NNSR [nonattainment new source review] … requirements, including the requirement to offset NO_X and VOC emissions." During the public comment periods for these permits, USEPA did not receive comments on these OCS statutory and regulatory requirements and/or the application of offset requirements for OCS sources' construction emissions.

Since the initial Vineyard Wind 1 permit was issued, USEPA has re-assessed the application of the offset requirements under the NNSR program to OCS sources subject to part 55. As a result of USEPA's re-assessment, USEPA determined that the emission offset requirements under the CAA and NNSR regulations do not apply to construction emissions on the OCS. USEPA interprets CAA sections 173, 40 CFR part 51 and the Massachusetts NNSR regulations to support the conclusion that offsets for construction emissions are not required for sources onshore and are also not required for OCS sources under section 328 of the CAA and 40 CFR part 55. USEPA discussed the basis for this interpretation in the October 20, 2021, Supplemental Fact Sheet for the South Fork Wind Farm permit action. After considering public comments received during the public comment period, on January 18, 2022, USEPA issued the final permit for the South Fork Wind Farm without requiring offsets for construction emissions, consistent with the direction in the October 20, 2022, Supplemental Fact Sheet and based on the rationale provided therein. To provide consistent treatment in the permitting of sources with similar characteristics, USEPA is proposing to modify the Vineyard Wind 1 permit to remove the requirement to obtain emission offsets for construction activities. The proposed permit modification does not alter any control technology requirements for OCS sources engaged in construction activities or any requirement in the permit to obtain emission offsets for operational emissions.

When the annual NO_x PTE for the O&M phase shown in Appendix A, Table A-1 is multiplied by the applicable offset ratio of 1.15:1, the resulting emission offset requirements is 28.81 tons per year of NO_x offsets. Thus, prior to commencement of construction, US Wind would identify and purchase emissions offsets for the O&M period emissions in accordance with MDE requirements. Based on the current MDE and NJDEP offset registry, US Wind anticipates that there would be ample NO_x emission offsets available for the Project prior to commencement of construction.

3.4.2 Analysis of Alternative Sites, Sizes, and Production Processes

COMAR 26.11.17.03 requires that any person subject to NNSR submit to the Department an analysis of alternative sites, sizes, production processes, including pollution prevention measures, and environmental control techniques, demonstrating that the benefits of the newly constructed, reconstructed, or modified equipment significantly outweigh the environmental and social costs imposed as a result of the location, construction, reconstruction or modification and operation of such equipment.

The Project is an offshore wind energy facility of up to approximately 2 gigawatts of nameplate capacity within OCS-A 0490 (the Lease), a Lease area of approximately 80,000 acres located approximately 18.5km (11.5 miles) off the coast of Maryland on the Outer Continental Shelf. US Wind obtained the Lease in 2014 when the company won an auction for two leases from the BOEM, which in 2018 were combined into the Lease. The Lease granted US Wind, subject to BOEM's approval of the Construction and Operations Plan (COP), the exclusive rights and privileges to conduct authorized activity to develop renewable energy in the Lease area, as set forth in Addendum A of the Lease. The Project includes MarWin, a wind farm of approximately 300 MW for which the State of Maryland awarded to US Wind Offshore Renewable Energy Credits (ORECs) in 2017; Momentum Wind, consisting of approximately 808 MW for which the State of Maryland awarded additional ORECs in 2021; and any subsequent developments authorized within the Lease area.

The location of an offshore wind lease area is the result of a multi-year effort by state and federal regulatory agencies to identify OCS areas suitable for offshore renewable energy development[24]. An extensive review of site characterization and an assessment of potential impacts was conducted, including environmental, economic, cultural, and visual resources, and use conflicts. Additionally, the Project conducted project screening and siting evaluations and a review of potential impact producing factors on various resources, including physical, biological, socioeconomic and others; these evaluations are presented in the US Wind COP.

3.4.2.1 Pollution Prevention Measures and Environmental Control Techniques

US Wind conducted LAER and BACT analyses as required to evaluate environmental controls for the Project's OCS sources (See Section 4). The LAER analysis concluded that add-on air pollution control is not technically feasible for the engines. However, the Project will select engines that are certified by the manufacturer to comply with applicable NSPS standards. US Wind will also utilize low-sulfur fuel whenever possible and will always comply with all applicable fuel sulfur content regulations and USEPA regulations for marine vessels.

3.4.2.2 Minimizing Environmental Costs

As part of the OCS air permitting, US Wind conducted air dispersion modeling for PM10, PM2.5, NO_2, SO_2, and CO to demonstrate that the Project will not cause or contribute to an exceedance of ambient air quality standards or PSD increment. Additionally, the Project will

24 Bureau of Ocean Energy Management (BOEM). 2012. Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf (OCS) Offshore New Jersey, Delaware, Maryland, and Virginia. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. Accessed at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Mid-Atlantic-Final-EA-2012.pdf

minimize environmental costs by complying with LAER and BACT standards as presented in Section 4. Finally, the use of wind to generate electricity results in a net reduction of regional air pollution over the life of the Project through displacement of electricity generated by fossil fuel-fired power plants. Therefore, by definition, the Project minimizes environmental cost.

3.4.2.3 Minimizing Social Costs

The Project generally results in social benefits to the community by providing clean energy. Construction activities may result in short-term and negligible to minor impacts to the population and local economies due to increased noise, traffic, and visible structures. During the O&M phase, the Project may have long-term impacts to the population and local economies due to visible structures. However, these long-term impacts are anticipated to be negligible. More information on potential impacts to population, economy, and employment resources are discussed in Volume II of the Project's COP.

3.4.3 Certification of Compliance

Per COMAR 26.11.17.03, US Wind is required to certify that all existing major stationary sources owned or operated by the applicant, or any entity controlling, controlled by, or under common control, in the State are in compliance with all applicable emission limitations or are in compliance with an approved federally enforceable plan for compliance.

US Wind was founded in 2011 and has established itself as Maryland's leader in offshore wind development. US Wind is majority-owned by Renexia SpA, a leader in renewable energy development in Italy and a subsidiary of Toto Holding SpA. Toto Holding SpA has more than 40 years of experience specializing in large construction and infrastructure projects, primarily in the energy, transportation, and aviation sectors. In 2020, Apollo Global Management became strategic investors in US Wind.

US Wind certifies that it does not own or operate any existing major stationary sources in Maryland.

Table 3-1: Tier 4 Emissions Standards (g/kW-hr)

Maximum Engine Power (kW)	PM	N0x	NMHC	NOx+ NMHC	CO
< 19	0.40	-	-	7.5	6.6
19 - 56	0.03	-	-	4.7	5.0
56 - 130	0.02	0.40	0.19	-	5.0
130 -560	0.02	0.40	0.19	-	3.5
> 560	0.03	0.67	0.19	-	3.5

From 40 CFR Part 1039.101(b)

Table 3-2: NSPS for Non-Emergency Stationary CI Internal Combustion Engines with a Displacement Less Than 30 Liters per Cylinder

Model Year	Engine Size (kW)	Displacement (liters per cylinder)	Standards
40 CFR part 60.4204(a)			
Pre-2007	all	<10	Table 1 of Subpart IIII
Pre-2007	all	10 ≤ D < 30	Marine CI Engine Standards: 40 CFR part 94
40 CFR part 60.4204(b)			
2007 or later	≤ 2,237	<10	New Nonroad CI Engine Standards: 40 CFR 1039.101, 1039.102, 1039.104, 1039.105, 1039.107, and 1039.115 and 40 CFR part 1039, appendix I, as applicable OR Marine CI Engine Standards: 40 CFR Part 1042
2007 – 2010	> 2,237	< 10	Table 1 of Subpart IIII OR Marine CI Engine Standards: 40 CFR Part 1042
2011 or later	> 2,237	<10	New Nonroad CI Engine Standards: 40 CFR 1039.101, 40 CFR 1039.102, 40 CFR 1039.104, 40 CFR 1039.105, 40 CFR 1039.107, and 40 CFR 1039.115, as applicable OR Marine CI Engine Standards: 40 CFR Part 1042
2007 - 2012	all	10 ≤ D < 30	New Marine CI Engine Tier 2 Standards: 40 CFR 1042
2013	≥ 3,700	10 ≤ D < 15	
2013	all	15 ≤ D < 30	
2013	< 3,700	10 ≤ D < 15	New Marine CI Engine Standards: 40 CFR 1042.101, 40 CFR 1042.107, 40 CFR 1042.110, 40 CFR 1042.115, 40 CFR 1042.120, and 40 CFR 1042.145, as applicable
2014 and later	All	10 ≤ D < 30	

Notes:

Category 1 Engine means:

a) For engines regulated under 40 CFR Part 1042 (Tiers 3 and 4), a marine engine with specific engine displacement below 7.0 liters per cylinder; or
b) For engines regulated under 40 CFR Part 1042 – Appendix I (Tiers 1 and 2), a marine engine with a rated power greater than or equal to 37 kilowatts and a specific engine displacement less than 5.0 liters per cylinder.

Category 2 Engine means:
a) For engines regulated under 40 CFR Part 1042 (Tiers 3 and 4), a marine engine with a specific engine displacement at or above 7.0 liters per cylinder but less than 30.0 liters per cylinder; or
b) For engines regulated under 40 CFR Part 1042 – Appendix I (Tiers 1 and 2), a marine engine with a specific engine displacement greater than or equal to 5.0 liters per cylinder but less than 30 liters per cylinder.

Category 3 Engine means a marine engine with a specific engine displacement greater than or equal to 30 liters per cylinder.

Table 3-3: NSPS for Non-Emergency Stationary CI Internal Combustion Engines with a Displacement of 30 Liters per Cylinder or More

Date	NO_x Limit, g/kWh			PM
	$n < 130$	**$130 \le n < 2000$**	**$n \ge 2000$**	Reduce particulate matter (PM) emissions by 60 percent or more, or limit the emissions of PM in the stationary CI internal combustion engine exhaust to 0.15 g/KW-hr.
Pre-2012	17.0	$45 \cdot n^{-0.2}$	9.8	
2012 - 2016	14.4	$44 \cdot n^{-0.23}$	7.7	
2016 and later	3.4	$9.0 \cdot n^{-0.20}$	2.0	
n= maximum engine speed in revolutions per minute				

Table 3-4: MARPOL Annex VI NO_x Emission Limits

Tier	Date	NO_x Limit, g/kWh		
		n <	**130 ≤ n < 2000**	**n ≥ 2000**
Tier I	2000	17.0	$45 \cdot n^{-0.2}$	9.8
Tier II	2011	14.4	$44 \cdot n^{-0.23}$	7.7
Tier III[1]	2016	3.4	$9 \cdot n^{-0.2}$	1.96

[1] In NO_x Emission Control Areas (Tier II standards apply outside ECAs).
Maximum engine speed in revolutions per minute

Table 3-5: Prevention of Significant Deterioration Regulatory Threshold Evaluation

Pollutant	Maximum Annual Emissions	PSD Significant Emission Rate	PSD Review Required
NO_x	615.6	40	Yes
VOC	11.3	40	No
CO	130.2	100	Yes
SO_2	2.0	40	No
PM10	20.0	15	Yes
PM2.5	19.4	10	Yes
Lead	0.003	0.6	No
GHGs (as CO_2e)	41,673	75,000	No
Sulfuric Acid Mist	0.09	7	No
Hydrogen Sulfide	None expected	10	No
Total reduced sulfur	None expected	10	No
Reduced sulfur compounds	None expected	10	No

Table 3-6: PSD Significant Impact Levels

Pollutant	Averaging Period	Recommended Significant Impact Levels for NAAQS Analyses (µg/m³)	PSD SIL Increments (µg/m³)	
			Class I	Class II
CO	1-Hour	2,000[1]	None	2,000[1]
	8-Hour	500[1]	None	500[1]
Pb	Rolling 3-Month	None	None	None
NO_2	1-Hour	7.5[2]	None	None
	Annual	1	0.1[1]	1[1]
O_3	8-Hour	1.96[3]	None	None
PM2.5	24-Hour	1.2[4]	0.27[4]	1.2[4]
	Annual	0.2[5]	0.05[5]	0.2[5]
PM10	24-Hour	5[1]	0.3[1]	5[1]
	Annual	1[1]	0.2[1]	1[1]
SO_2	1-Hour	7.8[2]	None	None
	3-Hour	25[1]	1[1]	25[1]
	24-Hour	5[1]	0.2[1]	5[1]
	Annual	1[1]	0.1[1]	1[1]

[1] Concentration not to be exceeded.
[2] Highest 1-hour Modeled concentration averaged over 3 years.
[3] Annual 4th Highest Daily Maximum 8-hour Concentration Averaged Over 3 years.
[4] Highest 24-hour modeled concentration averaged over 3 years.
[5] Highest annual modeled concentration averaged over 3 years.

Table 3-7: National Ambient Air Quality Standards, PSD Increments, and Significant Monitoring Concentrations

Pollutant	Averaging Period	NAAQS[a] ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)	Significant Monitoring Concentrations ($\mu g/m^3$)
Carbon Monoxide (CO)	1-Hour 8-Hour	40,000 10,000	-- --	-- 575
Nitrogen Dioxide (NO_2)	1-Hour Annual	188 100	-- 25	-- 14
Ozone (VOC)	8-Hour	137	--	--
Coarse Particulate Matter (PM10)	24-Hour Annual	150 --	30 17	10 --
Fine Particulate Matter (PM2.5)	24-Hour Annual	35 12	9 4	-- --
Sulfur Dioxide (SO_2)	1-Hour 24-Hour Annual 3-Hour	196 365 80 1,300	-- 91 20 512	-- 13 -- --
Lead (Pb)	3-Month	0.15	--	0.1

Note: (--) indicates there are no standards for this pollutant.

[a]All short-term (1-hr, 3-hr, 8-hr, and 24-hr) standards except ozone, PM2.5, PM10, and 1-hour SO_2 and NO_2 are not to be exceeded more than once per year. For 8-hr ozone, USEPA uses the average of the annual 4th highest 8-hour daily maximum concentrations from each of the last three years of air quality monitoring data to determine a violation of the standard. For 24-hour PM10, USEPA uses the 6th highest 24-hour maximum concentration from the last three years of air quality monitoring data to determine a violation of the standards. For 24-hour PM2.5, USEPA uses the 98th percentile 24-hour maximum concentration from the last three years of air quality monitoring data to determine a violation of the standard. For the 1-hour NO_2 NAAQS, compliance would be determined by the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area and for the 1-hour SO_2 NAAQS, compliance would be determined with the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area.

Table 3-8: Non-attainment NSR Major Source Evaluation

Pollutant	Maximum Annual Emissions (tons per year)	NNSR Major Thresholds (tons per year)	NNSR Review Required
Nitrogen Oxides	615.6	100[a]	Yes
Ozone (VOC)	11.3	50[a]	No

Note: [a]As precursors to ozone – ozone transport region threshold.

4.0 CONTROL TECHNOLOGY ANALYSIS

Control technology requirements for a proposed source or project depend on its potential to emit (PTE) for each regulated air pollutant, the designated air quality attainment status of the area where it is to be located, and the associated permitting/licensing requirements. Under federal NSR programs, sources and emission units at proposed projects subject to NNSR must meet LAER control technology requirements, and those subject to PSD review must satisfy BACT requirements. The MDE has a State Implementation Plan (SIP) approved pre-construction permitting program that incorporates both PSD and NNSR requirements.

The MDE adopts the federal BACT definition into COMAR 26.11.1701B(5). Specifically, BACT is defined in the Maryland regulations as follows:

"Best available control technology" means an emissions limitation (including a visible emissions standard) based on the maximum degree of reduction for each pollutant subject to regulation under Act (sic) which would be emitted from any proposed major stationary source or major modification which the Department, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of the pollutant.

In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR 60 and 61.

If the Department determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology.

Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of the design, equipment, work practice, or operation, and shall provide for compliance by means which achieve equivalent results.

LAER is defined in COMAR 26.11.1701B(15) as follows:

(a) *"Lowest achievable emission rate" means, for any emissions unit, the more stringent rate of emissions based on the following:*

(i) The most stringent emissions limitation which is contained in the implementation plan of any state for the class or category of stationary source, unless the owner

or operator of the proposed stationary source demonstrates that these limitations are not achievable; or

(ii) The most stringent emissions limitation which is achieved in practice by the class or category of stationary sources, with this limitation, when applied to a modification, meaning the lowest achievable emissions rate for the new or modified emissions units within the stationary source.

(b) *The application of this definition does not permit a proposed new or modified emissions unit to emit any pollutant in excess of the amount allowable under 40 CFR 60.*

Thus, taken together, BACT and LAER each require:

1. An emissions limitation,
2. That the limitation be achievable,
3. A case-by-case determination, and
4. That the limit be at least as stringent as any applicable regulation under 40 CFR Part 60 or 40 CFR Part 61.

BACT is unique in comparison to LAER in that BACT allows consideration of collateral impacts of control technologies, and specifically the energy, environmental, and economic impacts from a specific control technology. LAER is unique in comparison to BACT in that LAER requires that the limit be the most stringent limit for a comparable emissions unit technology or if the highest control efficiency of the option would result in an emission level that is higher than any applicable regulatory limits.

As discussed in Sections 2 and 3, the emissions increase from the proposed Project are above levels that would trigger the requirement for BACT and LAER under the federal NSR program. Also, the proposed Project is subject to MDE BACT requirements in accordance with COMAR Chapter 115. The Project is subject to the following control technology requirements:

- LAER applies to the NO_x emissions from OCS sources; and
- BACT per 40 CFR Part 52.21 (federal BACT) applies to emissions of NO_x, CO, PM10, and PM2.5, from OCS sources.

The following sections present BACT and LAER analyses for OCS equipment proposed as part of the Project.

4.1 Approach Used in BACT Analysis

A BACT analysis is a top-down process that objectively identifies the most stringent technically feasible emission control option, considering the energy consumption, economic feasibility (*i.e.,* cost effectiveness), and environmental impact of the control technology. BACT provides a case-by-case analysis for each source; therefore, a control option that has been determined to be BACT for one source is not necessarily BACT for another.

LAER is defined as the more stringent of (1) the most stringent emission limitation which is achieved in practice by the class or category of source or (2) the most stringent emission limitation contained in the applicable State Implementation Plan (SIP) (unless such emission rate is demonstrated not to be achievable), whichever is more stringent. LAER would be based upon the lowest permitted emission rates that are verified as being achieved in practice, as discussed in the appropriate section by pollutant. Pollutants are subject to LAER if potential emissions of individual pollutants exceed area-specific emission thresholds. The emissions of NO_x are subject to LAER requirements.

The BACT analysis for the Project was conducted consistent with the USEPA's five step "top-down" BACT process. Control options are first identified for each pollutant subject to BACT and evaluated for their technical feasibility and for energy, environmental, and economic impacts that may make the option infeasible. Options found to be feasible are ranked in order of their effectiveness and then compared based on their energy, economic, and environmental impacts. If the most stringent control identified is selected, no further analysis of impacts is performed. If the most stringent control is ruled out based upon energy, economic, or environmental impacts, the next most stringent technology is similarly evaluated until BACT is determined.

After establishing the baseline emissions levels required to meet any applicable federal New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAPs), or state SIP limitations, the "top-down" procedure outlined below is followed for each pollutant subject to BACT:

Step 1: Identify available control options from review of USEPA's RACT/BACT/LAER Clearinghouse (RBLC), agency permits for similar sources, literature review, and contacts with air pollution control system vendors.

Step 2: Eliminate infeasible options – Evaluation of each identified control option to rule out those technologies that are not technically feasible (*i.e.,* not available or applicable per USEPA guidance) or have energy, economic, or environmental impacts that make the alternative infeasible. Energy, economic, and environmental impact analyses are conducted in this step to determine if an option can be ruled out based on unreasonable energy, economic, or environmental impacts.

Step 3: Rank remaining control technologies – "Top-down" analysis, involves the ranking of control technology effectiveness and resulting emission rates.

Step 4: Evaluate the most effective controls and document results – Provide a case-by-case evaluation of energy, economic, and environmental impacts for the remaining control technologies. If the "top" or most stringent technology is not selected as BACT, the evaluation should consider the next most effective control option.

Step 5: Select the BACT based upon the highest ranked option that cannot be eliminated, which includes the development of an achievable emission limitation based on that technology.

In summary, the first step in a BACT analysis is to identify and rank all the control options according to their control efficiencies. The most stringent control option is then evaluated based on technical, economic, environmental, and energy-use criteria. If all factors are satisfied, the control option is considered BACT and the evaluation process is stopped. If one or more factors are unacceptable, then the next most stringent control option is evaluated. The analysis continues from the most stringent control option to the least stringent control option until a technology is deemed acceptable for all criteria. The control option that is considered the most feasible based on all criteria is BACT and must be implemented by the source.

As previously stated, BACT is defined as the optimum level of control applied to pollutant emissions based upon consideration of energy, economic and environmental factors. The BACT analyses may include reductions achieved through the application of processes, systems, and techniques for the control of each air pollutant. USEPA has placed potentially applicable control alternatives identified and evaluated in the BACT analysis into the following three categories:

1. Inherently lower-emitting processes/practices/designs;
2. Add-on controls; and
3. Combinations of (1) and (2).

Inherently lower-emitting processes/practices/designs

The USEPA New Source Review Workshop Manual (October 1990) includes the following discussion of inherently lower-emitting technologies:

> *"EPA has not considered the BACT requirement as a means to redefine the design of the source when considering available control alternatives. For example, applicants proposing to construct a coal-fired electric generator, have not been required by USEPA as part of a BACT analysis to consider building a natural gas-fired electric turbine although the turbine may be inherently less polluting per unit product (in this case electricity). However, this is an aspect of the PSD permitting process in which states have the discretion to engage in a broader analysis if they so desire. Thus, a gas turbine normally would not be included in the list of control alternatives for a coal-fired boiler. However, there may be instances where, in the permit authority's judgment, the consideration of alternative production processes is warranted and appropriate for consideration in the BACT analysis."*

Lower-polluting processes (including design considerations) should be considered based on demonstrations made on the basis of manufacturing identical or similar products from identical or similar raw materials or fuels.

Change in Raw Materials

This emissions limiting technique typically applies to industrial processes that use chemicals, such as solvents, where substitution with a lower emitting chemical may be technically feasible.

Process Modifications

Process modifications may be implemented if a change in the process methods or conditions can result in lower emissions.

4.1.1 Identify Potential Control Technologies

4.1.1.1 Inherently Lower-emitting Processes/Practices/Designs

Lower-polluting processes (including design considerations) should be considered in Step 1 of a BACT analysis based the USEPA New Source Review Workshop Manual (October 1990). Such processes should be considered based on demonstrating the manufacturing of identical or similar products can be achieved from identical or similar raw materials or fuels. Process modifications may be implemented if a change in the process methods or conditions can result in lower emissions. This emissions-limiting technique typically applies to industrial processes that use chemicals, such as solvents, where substitution with a lower emitting chemical may be technically feasible.

4.1.1.1 Add-On Controls

In addition to process modifications, identification of available technically feasible control technology options, including consideration of transferable and innovative control measures that may not have previously been applied to the source type are also considered in Step 1 of the BACT analysis. The minimum requirement for a BACT proposal is an option that meets federal regulatory limits or other minimum state or local requirements that would prevail in the absence of BACT decision-making. To identify options for each class of equipment, a search of the USEPA's RBLC was performed. Individual searches were performed for each pollutant subject to BACT emitted from each emissions unit.

If there is only a single feasible option, or if the applicant is proposing the most stringent alternative, then no further analysis is required. If two or more technically feasible options are identified, the next three steps are applied to identify and compare the economic, energy, and environmental impacts of the options. Technical considerations and site-specific sensitive issues would often play a role in BACT determinations. Generally, if the most stringent technology is rejected as BACT, the next most stringent technology is evaluated, and so on.

4.1.1.2 Achievability

BACT decisions are based on the premise that the limit established through the respective process must be achievable. However, there is an important distinction between emission rates achieved at a specific time on a specific unit, and an emission limitation that a unit must be able to meet continuously over its operating life. The USEPA has reached the following conclusion in prior determinations for PSD permits:

> *"Agency guidance and our prior decisions recognize a distinction between, on the one hand, measured 'emissions rates, ' which are necessarily data obtained from a particular facility at a specific time, and on the other hand, the 'emissions limitation' determined to be BACT and set forth in the permit, which the facility is required to continuously meet throughout the facility's life. Stated simply, if there is uncontrollable fluctuation or variability in the measured emission rate, then the lowest measured emission rate would necessarily be more stringent than the "emissions limitation" that is "achievable" for that pollution control method over the life of the facility. Accordingly, because the "emissions limitation" is applicable for the facility's life, it is wholly appropriate for the permit issuer to consider, as part of the BACT analysis, the extent to which the available data demonstrate whether the emissions rate at issue has been achieved by other facilities over a long term."*

Therefore, BACT must be set at the lowest feasible emission rate recognizing that the facility must be in compliance with that limit for the lifetime of the facility on a continuous basis. While viewing individual unit performance can be instructive in evaluating what BACT might be, any actual performance data must be viewed carefully, as rarely would the data be adequate to truly assess the performance that a unit would achieve during its entire operating life.

In addition, emission limits from existing permitted facilities must be used with caution in assessing what is "achievable." For example, limits established for facilities that were never built must be viewed with caution, since they have never been demonstrated and that facility/company/applicant never took a significant liability in having to meet that limit. Likewise, permitted units that have not yet commenced construction must also be viewed with caution for similar reasons.

4.1.2 Feasibility Analysis of Control Technologies

Technical considerations and site-specific issues often play a role in BACT determinations. In Step 2 of the BACT analysis, technically infeasible control technologies are eliminated from further consideration. Additionally, energy, economic, and environmental impact analyses are conducted in this step to determine if an option can be ruled out based on unreasonable energy, economic, or environmental impacts.

4.1.2.1 Energy Impact Analysis

Energy impacts may occur with some control options; these can be quantified. The installation of a control option may reduce the output and/or reliability of the proposed equipment and may result in increases in energy consumption. These impacts may be shown as incremental annual increases in electricity or fuel consumed.

4.1.2.2 Economic (Cost-Effectiveness) Analysis

This analysis consists of the estimation of costs and the calculation of the cost-effectiveness of each technically feasible inherently lower-emitting process/technology and/or control technology, based on dollars per ton ($/ton) of pollution removed. Annual emissions of an option are subtracted from base case emissions to calculate the tons of pollutant removed per year. The base case may be uncontrolled emissions or the maximum emission rate allowable without BACT that would generally correspond to a federal or state regulatory limit. The base case may also be emissions from a combustion technology. Annual costs, in dollars per year ($/yr), are calculated by adding annual operation and maintenance costs to the annualized capital costs of an option. Cost-effectiveness ($/ton) of an option is the equivalent annual cost ($/yr) divided by the annual reduction in emissions (ton/yr).

No economic analysis is required if either the most stringent control option is proposed as BACT or if there are no technically feasible control options.

4.1.2.3 Environmental Impact Analysis

The primary focus of the environmental impact analysis is the reduction in ambient concentrations of the pollutant being emitted. Increases or decreases in emissions of other criteria or non-criteria pollutants may occur with some technologies and should also be identified. Non-air related impacts, such as solid waste disposal and increases in water consumption/treatment, may be an issue for some projects and control options.
The net environmental impact associated with an alternative technology should be determined. Both beneficial impacts (*e.g.,* reduced emissions attributed to a control system or alternative technology) and adverse impacts (*e.g.,* exacerbation of another pollution problem through use of a control system or alternative technology) should be discussed and quantified. The environmental analysis is presented in the form of the incremental impact of alternative technology and/or control systems relative to the proposed technology.

4.1.3 BACT Determination

After determining the technical feasibility of a control technology and whether there are energy, economic, or environmental impacts that make the technology infeasible, the options that remain are ranked by control effectiveness in Step 3. If the "top" or most stringent technology is not selected as BACT, Step 4 must provide a case-by-case evaluation of the energy, economic, and environmental impacts of the remaining options. Generally, if the most stringent technology is rejected as BACT, the next most stringent technology is evaluated, and so on.

If there is only a single feasible option, or if the applicant is proposing the most stringent alternative, then no further analysis is required.

4.2 Approach Used in LAER Analysis

LAER is defined under 40 CFR Part 51 as the more stringent rate of emissions based on the following:

1. The most stringent emissions limitation which is contained in the implementation plan of any State for such class or category of stationary source, unless the owner or operator of the proposed stationary source demonstrates that such limitations are not achievable; or
2. The most stringent emissions limitation which is achieved in practice by such class or category of stationary sources. In no event shall the application of the term permit a proposed new or modified stationary source to emit any pollutant in excess of the amount allowable under an applicable new source standard of performance.

A LAER analysis was conducted for the emissions of NO_x that is consistent with the approach used for a BACT analysis, without taking into account economic considerations.

4.3 Federal and State Regulatory Analysis

The first step of the BACT and LAER analyses considers the regulations contained in any state SIP. These regulations would set the baseline emissions from the OCS sources that would then undergo detailed BACT/LAER analysis discussed in Sections 4.1 and 4.2. MDE has adopted the federal NSPS and NESHAPs standards.

Project-related emissions are from compression-ignition internal combustion engines. These include marine diesel, non-road diesel, transportation diesel, and stationary diesel engines. As such, a review of Federal and State regulations that are appliable to diesel engines was conducted.

Applicable emission limits for marine engines depend on the size, age and maximum power of the engine and whether the engine is considered an emergency or non-emergency engine. The emission limits for marine engines are divided into different Tier standards, ranging from Tier 1, which allows the least stringent emissions, to Tier 4, associated with the most stringent emissions limitations. The manufacturer of Tier 2 and higher internal combustion engines would build into the engines' design, air pollution control technologies such as turbocharger, aftercooler, and high injection pressure, with a Tier 4 engine having the most air pollution control technologies built into its design. Compliance with tiered standards set forth in the regulations is assured through a certification process. Recently, USEPA harmonized USEPA regulations with those of MARPOL (the International Convention for the Prevention of Pollution from Ships). Major differences between the USEPA and MARPOL compliance requirements are: (1) USEPA liability for in-use compliance rests with the engine manufacturer (it is the vessel operator in MARPOL), (2) USEPA requires a durability demonstration (under MARPOL, compliance must be demonstrated only when the engine is installed in the vessel), and (3) certain test conditions and parameters.

A summary of USEPA regulations that are applicable to marine compression ignitions is provided below:

- 40 CFR Part 1042 – Control Of Emissions From New and In-Use Marine Compression-Ignition Engines and Vessels
- 40 CFR Part 1043 - Control Of NO_x, SO_x, And PM Emissions From Marine Engines and Vessels Subject To The MARPOL Protocol
- 40 CFR Part 1065 - Engine-Testing Procedures
- 40 CFR Part 1068 - General Compliance Provisions For Highway, Stationary, and Nonroad Programs
- 40 CFR Part 80 - Regulation Of Fuels and Fuel Additives

USEPA's regulations for marine compression ignition (CI) engines in 40 CFR Parts 1042 and 1043 reduce NO_x and PM emissions and tighten emissions standards for large marine diesel engines when they are remanufactured.

These regulations include the following elements:

- Near-term engine-out emissions standards, referred to as Tier 3 standards, for newly built marine diesel engines; and
- Longer-term standards, referred to as Tier 4 standards, for newly built marine diesel engines that reflect the application of high efficiency aftertreatment technology.

Older USEPA regulations in 40 CFR Parts 92 and 94 include standards for emissions of PM, NO_x, hydrocarbons (HC) and CO from marine compression-ignition engines (also called marine diesel engines). These standards rely on engine-based technologies rather than aftertreatment technology to reduce air emissions.

Marine vessel regulations are structured so that the duty to comply rests primarily with the manufacturer. USEPA relied on testing information from engines equipped with specific technologies to establish the tiered emission standards for a variety of types of engines, recognizing considerations for safety specifically in the marine environment. The regulations were designed in such a way that manufacturers may use these anticipated technologies, or they may find better ways to meet emission standards over time. Manufacturers of diesel engines have typically met the standards with more careful control of intake air and fuel injection, with some exhaust gas recirculation, and under the regulations, owners are not required to retire their old engines, vehicles, or equipment. Long-term standards for many of these engines generally involve additional use of aftertreatment devices.

4.3.1 NSPS

Pursuant to 40 CFR Part 55.13(c), NSPS apply to OCS sources in the same manner as in the COA. A specific NSPS subpart applies to a source based on source category, equipment capacity, and the date when the equipment commenced construction or modification. Potentially applicable NSPS are discussed below. Although NSPS typically applies only to stationary sources, the broad definition of OCS source contained in the OCS Air Regulations require that some marine vessel engines and non-road engines be subject to NSPS.

There is one NSPS applicable to diesel fired engines: 40 CFR 60 Subpart IIII entitled "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines." The NSPS standards for CI engines contained in 40 CFR 60 Subpart IIII would apply to the engines used in the project. These standards are applicable for stationary IC engines with a displacement of less than 30 liters per cylinder where the model year is 2007 or later, and for engines that are not fire pump engines.

These regulations set air emission standards for both emergency and non-emergency engines. The engines that would be used in the construction and operation of this project include propulsion engines that would be used to power vessels as well as stationary engines used on equipment on the vessels, which typically would be only non-emergency engines. Because non-emergency engines would be used, the majority of this section details the NSPS requirements for non-emergency engines.

The NSPS requirements and emission limitations are grouped by the following engine characteristics:

- Whether the engine is an emergency or non-emergency engine

- Model year of the engine (date that construction commences is the date the engine is ordered by the owner/operator)
- Maximum power of the engine
- Displacement of the engine

4.3.1.1 NSPS Subpart IIII

The diesel generators used on the OSSs during construction, commissioning and during O&M must comply with 40 CFR Part 60, Subpart IIII. In the event that a vessel becomes an OCS source, any CI internal combustion engine that operates on that vessel while it is an OCS source would also become subject to Subpart IIII.

Owners and operators of non-emergency stationary CI internal combustion engines are subject to the NSPS emission standards in 40 CFR Part 60.4204. Per 40 CFR Part 60.4201(f), if the Project's non-emergency CI internal combustion engines have a displacement of less than 10 liters per cylinder, they may be certified to the provisions of 40 CFR Part 1042 (if Table 1 to 40 CFR 1042.1 identifies 40 CFR Part 1042 as being applicable), because the engines would be used solely at a marine offshore installation.

The NSPS for non-emergency compression-ignition internal combustion engines with a displacement of less than 30 liters per cylinder, particularly for engines located at a marine offshore installation, are essentially equivalent to compliance with USEPA's nonroad compression-ignition engine emission standards at 40 CFR Part 1039 or USEPA's marine compression-ignition engine standards at 40 CFR Part 1042. The only NSPS that does not cross reference USEPA's nonroad or marine compression ignition standards is for engines with a model year earlier than 2007 and a displacement of less than 10 liters per cylinder. USEPA's emission standards for nonroad and marine compression ignition engines are structured as a tiered progression, with each tier of emission standards becoming increasingly stringent. These standards are primarily a function of the size and age of the marine diesel engine. Each tier phased-in over several years (by categories of engine size).

The Project's Category 3 marine engines [25] with a displacement of 30 liters per cylinder or greater are subject to emission standards contained in 40 CFR Part 60.4204 when they become OCS sources. These NSPS standards are nearly identical to the Tier I, II, and III emission standards for marine vessel engines in Emission Control Areas under MARPOL Annex VI. Annex VI of MARPOL treaty, set forth by the International Maritime Organization, is the main international treaty that addresses air pollution from marine vessels. USEPA's

25 40 CFR Part 1042 defines Category 3 engines as marine engines with a specific engine displacement at or above 30 liters per cylinder.

emission standards for Category 3 marine compression-ignition engines are equivalent to NSPS and MARPOL Annex VI limits as well.

Per 40 CFR Part 60.4207, OCS sources that are CI ICE with a displacement of less than 30 liters per cylinder that use diesel fuel (as defined at 40 CFR Part 60.4219) must use diesel fuel that meets the fuel sulfur requirements of 40 CFR Part 80.510(b). CI ICE with a displacement of 30 liters per cylinder or more must use fuel with a maximum sulfur content of 1000 ppm. 40 CFR Part 80.510(b) limits the sulfur content of nonroad (NR) diesel fuel to 15 ppm and the sulfur content of locomotive or marine (LM) diesel fuel to 500 ppm. LM fuel is defined as "any diesel fuel or other distillate fuel that is used, intended for use, or made available for use, as a fuel in locomotive or marine diesel engines, except for the following fuels: (1) Fuel that is also used, intended for use, or made available for use in motor vehicle engines or nonroad engines other than locomotive and marine diesel engines is not LM diesel fuel.

4.3.2 National Emission Standards for Hazardous Air Pollutants (NESHAPs)

NESHAPs promulgated under Section 112 of the Clean Air Act and implemented in 40 CFR Parts 61 and 63 apply to OCS sources if they are related to the attainment and maintenance of Federal or State ambient air quality standards. See 40 CFR Part 55.13(e). 40 CFR Part 61 establishes NESHAPs for specific pollutants only at specified source categories. The Project would not have emission sources from these source categories, therefore, the regulation does not apply to the project.

HAPs refers to specified pollutants regulated under the Clean Air Act, including organic compounds and trace metals for which the USEPA has not established ambient air quality standards. HAPs are defined within 42 U.S.C. 7412, and accompanying regulations in 40 CFR Part 63, Subpart C. HAPs are regulated by the USEPA for various source categories under the NESHAPs program implemented as 40 CFR Part 63.

The Project is a non-major source of HAPs under 40 CFR Part 63 because its potential emissions are less than ten (10) tpy of any single HAP and less than 25 tpy of all HAPs combined. An area source is defined as any stationary source of HAPs that is not a major source of HAPs. The Project is not a major source of HAPs; it is an area source. The only NESHAPs potentially applicable to the Project are 40 CFR Part 63 Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.

4.3.2.1 NESHAP Subpart ZZZZ

The Project's OCS sources that are internal combustion engines are subject to 40 CFR Part 63, Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for

Stationary Reciprocating Internal Combustion Engines), which applies to major and area sources of HAPs. Although 40 CFR Part 63, Subpart ZZZZ typically applies only to stationary sources, the broad definition of OCS source contained in the OCS Air Regulations require that some non-stationary engines (e.g. marine vessel engines and non-road engines) be subject to this subpart.

According to 40 CFR Part 63.6590(c):

> *"An affected source that meets any of the criteria in paragraphs (c)(1) through (7) of this section must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.*

Any of the Project's internal combustion engines that become OCS sources and were built or reconstructed after June 12, 2006, meet the criteria in paragraph (c)(1) because those engines are considered "a new or reconstructed stationary RICE located at an area source." Therefore, RICE OCS sources that were built or reconstructed after June 12, 2006 must meet the requirements of 40 CFR Part 60, Subpart IIII and are not subject to any further requirements under 40 CFR Part 63. See Section 4.3.1 above for a discussion of 40 CFR Part 60, Subpart IIII.

The Project's existing RICE (constructed or reconstructed before June 12, 2006) that are OCS sources are subject to 40 CFR 63.6603, which applies to existing stationary RICE located at an area source of HAP emissions (40 CFR Part 63.6590(a)(1)(iii)). Under 40 CFR Part 63.6603, there are special requirements for certain existing stationary non-emergency CI RICE that are located on an offshore vessel that is an area source of HAPs.

All internal combustion engines utilized by the Project that were constructed or reconstructed before June 12, 2006, and that are considered OCS sources are subject to 40 CFR Part 63.6603. NESHAP Subpart ZZZZ contains emissions limits and operating requirements that apply to these engines, including the fuel requirements in 40 CFR Part 63.6604.

4.3.3 Maryland Regulations

A discussion of Maryland air regulations appliable to the Project is provided in Section 3.7. These MDE regulations reference the federal NSPS and NESHAPS regulations discussed earlier.

4.4 LAER Analysis for Nitrogen Oxides (NO_X)

4.4.1 Identify Potential Control Technologies for NOx

To identify potential control technologies or techniques for NO_X, the USEPA's RBLC for emission sources like those included in the Project was searched. Copies of the search results are found in Tables 4-1 through 4-6.

The RBLC summarizes the source, the emission limit, and the type of emission limit. The RBLC was searched for the last ten years from the following process categories:

- Large Internal Combustion Engines (> 500 hp) – Fuel Oil (Process Type 17.110);
- Small Internal Combustion Engine (< 500 hp) – Fuel Oil (Process Type 17.210); and
- Misc. Internal Combustion Engines (Process Type 19.800)

In addition to a search of the USEPA's RBLC, the following data sources were assessed:

- California Air Resource Board BACT Clearinghouse
- USEPA Regulatory Impacts Analyses - *Regulatory Impact Analysis: Control of Emissions of Air Pollution from Category 3 Marine Diesel Engines* (EPA-420-R-09-019, December 2009) and *Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder* (EPA-420-R-08-001, March 2008).
- Recent OCS Air Permit/PSD permits issued by the USEPA and their associated Statement of Basis

Potential add-on emission control technologies and emission reduction techniques for NO_x are reviewed below. The technical feasibility of applying control technologies and techniques to the emission sources included in the Project are addressed in further detail in the following sections of this analysis. There are several demonstrated methods available for controlling NO_x emissions including the methods listed below.

- Engine design, including turbocharging and aftercooling;
- Selective Catalytic Reduction (SCR);
- Selective Non-Catalytic Reduction (SNCR);
- Use of certified engine/compliance with NSPS; and
- Good Design and Operating Practices.

4.4.2 Recent LAER Determinations

US Wind reviewed numerous USEPA air permits, their associated Statement of Basis, and related application materials for sources similar to the marine diesel engines proposed for the Project. During this review, US Wind found only two (2) OCS air permits that included a LAER determination for NO_x. The Projects were the Vineyard Wind 1 Project (EPA Permit Number OCS-R1-03-M1) and the South Fork Wind Project (EPA Permit Number OCS R1-04).

The Vineyard Wind 1, LLC OCS air permit was issued on August 19, 2022, for the installation and operation of an 800 MW offshore wind energy project in the Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0501.

The South Fork Wind Farm OCS permit was issued on January 18, 2022, for the installation and operation of a 130 MW windfarm in the Rhode Island-Massachusetts Wind Energy Area. The location of the Rhode Island-Massachusetts Wind Energy Area comprises two original larger lease areas OCS-A-0486 and OCS-A-0487. A portion in the northern lease area of OCS-A-0486 (now OCS-A-0517) is where the South Fork Wind Farm would be located.

4.4.2.1 Vineyard Wind Offshore Renewable Energy Project

The Vineyard Wind Offshore Renewable Energy Project, as proposed by Vineyard Wind 1, LLC (Vineyard Wind), is an 800-MW project utilizing sixty-two (62), 13 MW GE Haliade-X wind turbines connected to an OSS, where power generated by the turbines would be transferred to two offshore export cables that would make landfall at Covell's beach. The Project broke ground on November 19, 2021. USEPA Region 1 issued Vineyard Wind an OCS air permit on August 19, 2022[26]. Vineyard Wind conducted an extensive LAER analysis for NO_x and VOC for the August 2018 OCS air permit application. Vineyard Wind's LAER analysis included identifying previous permit limits and LAER determinations for similar sources from other projects. Vineyard Wind's search of the RBLC database did not identify any previous permits or LAER determinations for emission sources similar to those proposed for the Vineyard Wind project.[27]

Based on precedent and available technical guidance, Vineyard Wind determined that replacing or retrofitting vessel engines, including implementing add-on controls, such that the engines meet a particular emission standard is not technically feasible for several reasons, including:

- *Vineyard Wind would not know what vessels (and hence engines) would be used until much closer to the start of construction; vessel data is highly speculative at this stage of the Project…"*
- *The Project's vessels, and their operating schedule are not under Vineyard Wind's control (all vessels that are OCS sources would be third-party vessels)*
- *Mandating upgrades to specific marine engines for a project's short-term construction period would inhibit Vineyard Wind (or any other offshore wind developer) from being able to substitute vessels in response to schedule changes or other construction issues, which could impose significant costs or delays that prevent the Project (or any other offshore wind project) from being built.*

26 https://www.epa.gov/system/files/documents/2022-08/vw1-ocs-air-permit-modification-ocs-r1-03-m1.pdf
27 Epsilon Associates, Inc. 2018, August 17. Outer Continental Shelf Air Permit Application: Vineyard Wind Project. Retrieved from https://www.regulations.gov/docket/EPA-R01-OAR-2019-0355/document.

Additionally, Vineyard Wind determined that waiting until particular vessels are available, which have engines that are retrofitted or employ add-on control technologies, is not feasible because:

> *Waiting for vessels that use add-on NO_x controls would significantly damage the Project's construction schedule, which would likely result in higher actual overall NO_x emissions and impose significant costs that could prevent the Project (and similarly any other offshore wind project) from being built. Similarly, retrofitting engines that would only be used during 1-2 years of construction or for periodic O&M activities with NO_x add-on control technologies is not achievable as LAER because it would impose control costs so great that no major offshore wind farm could be built. Furthermore, Vineyard Wind would not own any vessels that are subject to LAER and would have limited ability to demand retrofits to vessels that the company does not own.*

As described in the draft New Source Review Workshop Manual[28]:

> A LAER is not considered achievable if the cost of control is so great that a major new source could not be built or operated. This applies generically, i.e., if no new plants could be built in that industry if emission limits were based on a particular control technology.

Therefore, because replacing, retrofitting, or waiting for vessels that utilize add-on controls would impose significant costs that could prevent the Project and other similar offshore wind projects from being built, these control measures are not considered achievable as LAER.

In the OCS air permit issued by USEPA Region 1 (Permit No. OCS-R1-03), LAER was determined to be the highest tier internal combustion engine at the time of deployment as follows:

1. The Permittee while owning, operating, or having control of a seagoing vessel shall not cause, suffer, allow, or permit, aboard said vessel, tube blowing or soot removal activities that cause or contribute to a condition of air pollution.

2. The Permittee shall only burn ULSD, Marine Distillate, or Marine Residual fuels when operating any diesel-fired emission unit.

3. The Permittee shall ensure that all category 1 and 2 engines on all domestic and foreign flagged feeder jack-up vessels, domestic and foreign flagged supply vessels, and secondary crew transfer vessels, while those vessels are operating as an OCS source, meet the Tier 4 marine engine emission limits in 40 CFR Part 1042.101, except if one of the conditions in

28 US Environmental Protection Agency (EPA). 1990, October. New Source Review Workshop Manual. Prevention of Significant Deterioration and Nonattainment Area Permitting. Retrieved from https://www.epa.gov/nsr/nsr-workshop- manual-draft-october-1990.

subparagraph 3.a. or 3.b., below, is met, in which case the Permittee may use a marine engine meeting the emissions limits for the next lower Tier (i.e., Tier 3). Similarly, in the event that one of the conditions in subparagraph 3.a or 3.b., below, is met regarding the use of a marine engine meeting Tier 3 emissions limits, the Permittee may use a marine engine meeting the Tier 2 emission limits in 40 CFR Part 1042 – Appendix I in lieu of a marine engine meeting Tier 3 emission limits. All marine engines operating on domestic and foreign flagged feeder jack-up vessels, domestic and foreign flagged supply vessels, and secondary crew transfer vessels while those vessels meet the definition of an OCS source, shall meet the emission limits for a Tier 3 or 4 marine engine in 40 CFR Part 1042.101 or 40 CFR Part 1042 – Appendix I for a Tier 2 marine engine, whichever is applicable. In order to use a lesser Tier marine engine, as described above, one of the following conditions must be met:

a. A vessel with a higher Tier engine is not available within two hours of when the vessel must be deployed;

b. The total emissions associated with the use of a vessel with the higher Tier engine(s) would be greater than the total emissions associated with the use of the vessel with the next lower Tier engine(s). For purposes of this subparagraph, when determining the total emissions associated with the use of a vessel with a particular engine, the Permittee may include the emissions of the vessel that would occur when the vessel would be in transit to the WDA from the vessel's starting location.

4. The Permittee shall ensure that all category 1 and 2 engines for domestic flagged vessels operating as an OCS source that do not meet the definitions for any type of feeder jack-up vessel, supply vessel, or primary or secondary crew transfer vessel, are certified to meet the Tier 4 marine engine standards in 40 CFR Part 1042.101, except if one of the conditions in subparagraph 4.a. or 4.b., below, is met, in which case the Permittee may use the next lower Tier marine engine (i.e., Tier 3). Similarly, in the event that one of the conditions in subparagraph 4.a or 4.b., below, is met regarding the use of a Tier 3 marine engine, the Permittee may use a Tier 2 marine engine in lieu of a Tier 3 marine engine. In the event that one of the conditions in subparagraph 4.a or 4.b. is met regarding the use of a Tier 2 marine engine, the Permittee may use a Tier 1 engine in lieu of a Tier 2 marine engine. All engines operating on any vessel that is not a jack-up vessel, supply vessel, or primary or secondary crew transfer vessel while that vessel meets the definition of an OCS source, shall be certified as meeting the emission limits for a Tier 3 or 4 marine engine in 40 CFR Part 1042.101 or Tier 1 or 2, and 40 CFR part 1042 – Appendix I, depending upon whichever Tier the marine engine is certified to meet. In order to use a lesser Tier marine engine, as described above, one of the following conditions must be met:

a. A vessel with a higher Tier engine is not available within two hours of when the vessel must be deployed;

b. The total emissions associated with the use of a vessel with the higher Tier engine(s) would be greater than the total emissions associated with the use of the vessel with the next lower Tier engine(s). For purposes of this subparagraph, when determining the total emissions associated with the use of a vessel with a particular engine, the Permittee may include the emissions of the vessel that would occur when the vessel would be going to the WDA from the vessel's starting location;

5. The Permittee shall ensure that all engines on all foreign flagged vessels not regulated by permit condition IV.D.3, and all Category 3 engines on domestic flagged vessels, while those vessels are operating as an OCS source, are certified to meet either the MARPOL Annex VI (Annex VI) Tier III NO_x limits in the case of a foreign-flagged vessel, or USEPA's Tier 3 marine engine standards in the case of U.S.-flagged vessel, in Table 2 of this permit [Removed for simplification], except if one of the conditions in subparagraph 5.a. or 5.b., below, is met, in which case the Permittee may use the next lower Tier marine engine (i.e., Annex VI Tier II or USEPA Tier 2). Similarly, in the event that one of the conditions in subparagraph 5.a or 5.b., below, is met regarding the use of an Annex VI Tier II or USEPA Tier 2 marine engine, the Permittee may use an Annex VI Tier I or USEPA Tier 1 marine engine in lieu of an Annex VI Tier 2 or USEPA Tier 2 marine engine. All marine engines operating on a foreign vessel, and all Category 3 engines on a U.S. vessel, while that vessel meets the definition of an OCS source, shall be certified as meeting the relevant NO_x emission limits for Annex VI or USEPA marine engines in Table 2, depending upon whichever Annex VI or USEPA Tier the marine engine is certified to meet. In order to use a lesser Annex VI or USEPA Tier marine engine, as described above, one of the following conditions must be met:

   a. A vessel with a higher Annex VI or USEPA Tier engine is not available within two hours of when the vessel must be deployed;

   b. The total emissions associated with the use of a vessel with the higher Annex VI or USEPA Tier engine(s) would be greater than the total emissions associated with the use of the vessel with the next lower Annex VI or USEPA Tier engine(s). For purposes of this subparagraph, when determining the total emissions associated with the use of a vessel with a particular engine, the Permittee may include the emissions of the vessel that would occur when the vessel would be going to the WDA from the vessel's starting location;

   c. For category 3 engines on domestically flagged vessels, with a model year of 2011 or later, those engines must comply with an HC emission limit of 2 g/kW-hr and a CO emission limit of 5 g/kW-hr. [40 CFR Part 1042.104(a)]

6. The Permittee shall ensure that all engines on all foreign flagged vessels, and category 3 engines on domestically flagged vessels, with a model year before 2011, while those vessels are operating as an OCS source, use good combustion practices based on the most recent manufacturer's specifications issued for these engines at the time that these engines are operating under this permit.

7. The Permittee shall ensure that all engines on vessels not included in condition IV.D.6, while those vessels are operating as an OCS source, use good combustion practices based on the most recent manufacturer's specifications issued for these engines at the time that these engines are operating under this permit.

8. The Primary Crew Transfer Vessel, while operating as an OCS source, shall have all engine(s) certified as meeting the highest Tier engine for marine engines in 40 CFR Part 1042.101. Tier 4 emission standards apply to engine(s) at or above 600 kW, and Tier 3 emission standards apply to engine(s) below 600 kW. These emission standards apply during the construction and operational phases of the WDA facility. If after the Primary Crew Transfer Vessel is deployed it is necessary to deploy additional Crew Transfer Vessels to the WDA, those additional Crew Transfer Vessels shall meet the requirements of subparagraph 3 above.

4.4.2.2 South Fork Offshore Renewable Energy Project

The South Fork Wind Offshore Renewable Energy Project, as proposed by South Fork Wind, LLC (South Fork), is a 180-MW project utilizing up to fifteen (15), 6 to 12 MW wind turbines connected to an OSS, where power generated by the turbines would be transferred to an offshore export cable that would make landfall in East Hampton, New York. USEPA Region 1 issued South Fork an OCS air permit on January 18, 2022.

South Fork conducted an extensive LAER analysis for NO_x for the Project's OCS sources in their September 2020 OCS air permit application[29]. The LAER determination for engines while vessels are operating as OCS sources in the OCS air permit issued by USEPA Region 1 (Permit No. OCS-R1-04) was almost identical to the LAER determination for Vineyard Wind, with minor wording differences.

29 CH2M. 2020, South Fork Wind Outer Continental Shelf Air Permit Application: South Fork Wind, LLC https://www.regulations.gov/docket/EPA-R01-OAR-2021-0392/document

4.4.3 *Change in Raw Materials*

This emission limiting technique is typically considered for industrial processes that use chemicals such as solvents where substitution with a lower emitting chemical may be technically feasible. In this case, the "raw material" is a fuel to be combusted for the generation of electricity or mechanical energy. The fuel used by marine engines must be readily available, able to be stored on the vessel, and fired without the need for external energy input since the engines would be located away from any pipeline fuel supplies. This requirement limits the potential fuels to marine residual fuel, marine distillate fuel, ULSD, liquefied natural gas, and liquefied petroleum gas/propane.

The Project would comply with all applicable rules regarding usage of marine residual fuel, marine distillate fuel and ULSD. Although the combustion of ULSD would result in fewer NOx emissions than residual or distillate fuel, the use of ULSD is not always technically feasible especially for Category 3 engines. There are several reasons use of ULSD may not be technically feasible for certain engines, including the low lubricity, low viscosity, and low density of ULSD compared to traditional marine fuels.

4.4.4 *Process/Operation Modifications*

Process modifications are typically considered for industrial processes that use chemicals where a change in the process methods or conditions may result in lower emissions. In this case, the "process" is a marine or stationary internal combustion engine. In the case of marine and stationary diesel engines, "process modifications" refers to engines that have been optimized to meet top-Tier emission standards relative to older engines. Most process modifications are intrinsic to the design of the specific marine engine. Some process modifications can be made to engines via retrofits. Therefore, use of a marine diesel engine that has been optimized to minimize NO_x emissions via process modifications requires US Wind to require their contractors to:

- Wait for a vessel with engines that already incorporate these process modifications (i.e., newer engines that would have lower NOx emissions based on the applicable USEPA regulation);
- Replace old engines with engines that use these technologies; or
- Retrofit a vessel's engine to have lower NO_x emissions via process modifications.

It is not technically feasible to slow down, delay, or extend the Project's construction schedule to allow use of a vessel with lower NO_x emissions. It is also not technically feasible to limit the pool of vessel engines to those meeting Tier 3 (Category 3 engines) or Tier 3 or 4 (Category 1 and 2 engines) standards. Moreover, any such restrictions would likely result in higher actual overall NO_x emissions due to:

- Emissions from the lower NO_x-emitting vessel as it travels significant distances to reach the WDA; and

- Emissions from the Project's other construction sources idling during the delay caused by waiting to acquire the lower NO_x-emitting vessel.

US Wind must be able to draw vessels from the existing fleet of vessels as needed to meet project demands during construction, commissioning, and O&M periods. Consequently, the pool of third-party engines that could potentially become regulated as OCS sources due to anchoring or attaching to an OCS source is undefined. Thus, it would not be possible to ensure Tier 4 vessel emissions for all construction and O&M vessels.

It is not feasible for US Wind to require that third-party contractors replace or retrofit vessel engines to reduce emissions. US Wind does not yet know specifically which vessels would be utilized during construction and vessel availability is anticipated to be constrained, in addition to limitations imposed by the Jones Act. Additionally, the vessels that would be utilized during construction are not under US Wind's control since every vessel that would be an OCS source would be a third-party vessel. Requiring the replacement or retrofit of specific vessel engines for a short-term construction project would prevent US Wind from being able to substitute vessels on short notice due to schedule changes or other construction issues.

Waiting for lower emitting vessels is also largely infeasible since the lower-emitting vessel would likely need to travel significant distances to reach the Project because many of the larger, more specialized, vessels are in limited supply. The result of waiting for a lower-emitting vessel from a far distance would likely offset the benefits of using a lower emitting vessel. Furthermore, the Project's other construction equipment would idle during the delay caused by waiting for the lower-emitting vessel to arrive on-site.

US Wind understands that there is a balance between prioritizing lower-emitting vessels while also not jeopardizing the Project's construction schedule or causing excess emissions over greater distances. Therefore, US Wind proposes the same approach as South Fork Wind is taking for prioritizing lower-emitting vessels as outlined below.

1. For all domestic and foreign-flagged vessels, when/if meeting the definition of an OCS source, must meet Tier 4 emission limits as outlined in 40 CFR 1042.101, except if one the below conditions are met. In the case of one of these conditions being met, a Tier 3 vessel may be used. If one of these conditions are met for Tier 4 and Tier 3 vessels, then a Tier 2 vessel may be used, etc.
2. A vessel with a Tier 4 engine is not available within two hours of when the vessel must be deployed; or
3. The total emissions associated with the use of a vessel with Tier 4 engines would be greater than the total emissions associated with the use of the vessel with the next lower.

In summary, it is not technically feasible for US Wind to propose process modifications for individual construction marine diesel engines to meet LAER, either by retrofitting or replacing specific marine engines, due to the following reasons:

US Wind would not know what vessels (and associated propulsion and auxiliary engines) would be used until much closer to the start of construction; vessel data is highly speculative at this stage of the Project. The specific vessels used for the Project's construction and operation are subject to change on short notice due to variable availability and limitations associated with the Jones Act.

- The Project's vessels, and their operating schedule, are not under US Wind's control (all vessels that are OCS sources would be third-party vessels).

- Mandating upgrades to specific marine engines for a project's short-term construction period would inhibit US Wind (or any other offshore wind developer) from being able to substitute vessels in response to schedule changes or other construction issues, which could impose significant costs or delays that prevent the Project (or any other offshore wind project) from being built.

- During the O&M phase, vessels that are used infrequently for larger maintenance or repair activities would be contracted for short periods. Mandating upgrades to specific marine engines for a project's short-term O&M activities would inhibit US Wind from being able to substitute vessels in response to schedule changes or unplanned O&M activities, which could impose significant costs or delays that prevent the Project (or any other offshore wind project) from operating.

4.4.5 Aftertreatment Control Technologies

The following Sections discuss emission control technologies that involve the use of aftertreatment devices, which are placed in an engine's exhaust system.

4.4.5.1 Selective Catalytic Reduction (SCR)

SCR involves chemical reduction of NO_x with a reduction agent and a catalyst. The SCR process chemically reduces NO_x into molecular nitrogen and water vapor by passing the hot exhaust gases across a catalyst bed. A nitrogen-based agent, such as ammonia or urea, is injected into ductwork downstream of typically a combustion source. The reagent and combustion exhaust enter a reactor bed containing the catalyst where the reagent reacts selectively with the NO_x within a specific temperature range in the presence of the catalyst and oxygen. Typical temperature ranges from 480 to 800 °F where reduction of 70 percent to 90 percent can be achieved. The technology is best suited for clean burning fuels, as high levels of sulfur and particulate matter can poison the SCR catalyst rendering it ineffective and causes operational problems due to blinding/fouling of the catalyst and creating a greater pressure drop across the reactor bed.

SCR is a commonly used add-on pollution control technology that significantly reduces NO_x emissions from diesel engines. The SCRs are operated with a relatively narrow exhaust gas temperature window; below approximately 650°F the reaction is too slow and NO_x removal efficiency is reduced, while above 850°F the catalyst is rapidly destroyed. Since sulfur compounds can reduce the effectiveness of an SCR catalyst, ULSD should be used in diesel engines outfitted with SCR.

4.4.5.2 Selective Non-Catalytic Reduction (SNCR)

SNCR involves chemical reduction of NO_x with a reduction agent at elevated temperatures. A nitrogen-based agent, such as ammonia or urea, is injected into the post combustion flue gas stream. The SNCR process chemically reduces NO_x to molecular nitrogen and water vapor. SNCR has been shown to achieve NO_x reductions in the range of 30 to 50 percent. Because it doesn't include catalysts and a reactor bed, SNCR is better suited for applications with higher levels of particulate in the exhaust gas stream. In general, the ammonia or urea must be injected at a location in the exhaust duct or combustion source where the gas temperature is between 1,550 and 1,950 °F. The temperature must remain in this range for at least one second. Higher NO_x reduction efficiencies are attained when the gas temperature is between 1,600 and 1,800 °F and the residence time exceeds one second.

4.4.5.3 4-Way Catalyst

A 4-way catalytic converter can simultaneously reduce emissions of CO, HC, NO_x, and PM on a single support. 4-way catalytic converters can enable diesel engines to meet stringent emission limitations while minimizing the space needed for post-combustion treatment systems.

4.4.6 Good Design and Operating Practices

Good design includes process and mechanical equipment designs which are either inherently lower polluting or are designed to minimize emissions. Good operating practices include operating methods and procedures to minimize emissions.

4.4.6.1 Engine Design/Turbocharging and Aftercooling

Turbochargers reduce NO_x emissions by increasing air flow to the combustion chamber. Turbochargers use the pressure of the exhaust gas to drive a turbine/compressor into the combustion air intake system, forcing additional air into the combustion chamber for more power production. Aftercoolers employ heat exchangers in the combustion air system to reduce air temperature downstream of a turbocharger, thereby making the air denser and providing more oxygen for combustion. When used together, turbochargers and aftercoolers have been shown to achieve NO_x reductions of up to 20 percent.

4.4.7 NO_x Limits in State Implementation Plans (SIPs)

Emission limitations in SIPs are almost always associated with Reasonably Available Control Technologies (RACT) for equipment designed to be truly stationary sources, which would not apply to marine diesel engines. In any event, these emission limits are very unlikely to be more stringent than the federal and international regulations that that apply to marine engines (e.g. NSPS, MARPOL, 40 CFR Part 1042, etc.).

The following USEPA-approved statues and regulations related to compression-ignition internal combustion engines on vessels are incorporated into California's SIP:

- Airborne Toxic Control Measure for Commercial Harbor Craft (17 CCR Part 93118.5, excluding (e)(1)).

Airborne Toxic Control Measure for Commercial Harbor Craft" (Commercial Harbor Craft Regulation) requires all engines in newly acquired harbor craft that are intended to operate in any Regulated California Waters to be certified to meet the USEPA Tier 2 or Tier 3 marine standards in effect at the time of acquisition (CCR Part 93118.5(e)(3) and (4)). Under this regulation, newly acquired in-use_marine engines are not required to meet Tier 4 marine standards, but engines that are already certified as meeting Tier 4 marine standards cannot be replaced with lower Tier engines (CCR Part 93118.5(e)(3)). Any newly acquired new vessels must meet applicable Tier 2, 3, or Tier 4 marine standards in effect at the date of vessel acquisition ((CCR Part 93118.5(e)(4)). The NOx emission limits incorporated into California's SIP are based on USEPA's marine standards are therefore the same as those promulgated in 40 CFR 1042. Vessels that could become OCS sources would not be bought, leased, rented, or otherwise "newly acquired" by US Wind. Instead, US Wind would contract with marine construction firms for specific construction tasks, and US Wind would not control the vessels. Therefore CCR Part 93118.5(e)(3) and CCR Part 93118.5(e)(4) do not apply to US Wind's OCS sources.

The Commercial Harbor Craft Regulation also requires the eventual replacement or cleanup of pre-Tier 1 or Tier 1 engines used in ferries, excursion vessels, tugboats, towboats, push boats, crew boats, supply vessels, barges, and dredge vessels. Under CCR Part 93118.5(e)(6), Tier 1 and earlier engines in these vessel types must meet emission limits equal to or cleaner than Tier 2 USEPA marine standards through engine replacement, modification, or retrofit by the dates provided in the compliance schedules. The compliance dates are designed to clean up the fleet's oldest and dirtiest engines first, while giving more time for relatively newer, Tier 1 engines to be upgraded or replaced (CCR Part 93118.5(e)).

With respect to vessels that become OCS sources, jack-up vessels used to transport WTG components from the construction staging area to the WDA meet the definition of "crew and supply vessel" as defined in CCR Part 93118.5(d). Therefore, these vessels would be required under CCR Part 93118.5(e) to replace their Tier 1 and earlier engines with those meeting Tier 2 or higher marine or off-road engine emission standards if they were in California Waters. Any person subject to CCR Part 93118.5(e)(3) may not sell, purchase, offer for sale, lease, rent, import, or otherwise acquire a new or in-use diesel engine for an in-use harbor craft intended for use in Regulated California Waters unless the engine is certified to meet the Tier 2 or Tier 3 emission standards in effect at the time of acquisition (with some exemptions for replacing engines due to equipment failure).

Not all jack-up vessels that become OCS sources would fall under the definition of "crew and supply vessels." For example, under the California Commercial Harbor Craft Regulation, the main WTG installation jack-up vessel would fall under the definition of "work boat," which is not subject to CCR Part 93118.5(e). No vessels that become OCS sources due to anchoring (e.g. cable-laying vessels) are anticipated to meet the definition of "tugboat," "towboat," "crew and supply vessel," "barge," and "dredge" and therefore, would not be subject to the requirement to have Tier 2 or higher engines. If crew and supply vessels become OCS sources by tethering to an OCS source (e.g. WTGs or OSSs), these vessels would be subject to CCR Part 93118.5(e).

In summary, the California SIP requires certain defined vessels to have engines certified to at least Tier 2 standards. The USEPA has identified within OCS air permits that these certain defined vessels, are jack-up vessels and certain crew and supply vessels, even if these vessels are foreign flagged, would be regulated by the CA SIP and would need all engines to meet at least the emission standards for Tier 2 engines in 40 CFR Part 94.

Aside from the NO_x emission standards for marine compression-ignition engines incorporated into California's SIP, US Wind found no other NO_x emission limitations relating to marine internal combustion engines in SIPs.

4.4.8 Feasibility Analysis of NOx Control Technologies

Add-on controls remove emissions after they have been generated by a process. In this case, add-on controls would remove emissions from the internal combustion engine exhaust stream. No verified NO_x add-on control technologies for marine internal combustion engines were identified in a review of the USEPA Verified Technologies List and the California Air Resources Board Verified Technologies List. US Wind identified several potential add-on control technologies to reduce NO_x emissions that could be implemented by vessel or marine engine manufacturers during initial construction or major reconstruction. These technologies are described in Section 4.4.5 and include:

- SCR
- Selective Non-catalytic Reduction (SNCR)

- 4-way Catalytic Converter

None of these technologies are considered technically feasible for the reasons listed below:

4.4.8.1 SCR

Although this technology has been implemented on marine diesel engines, this technology has been considered technically infeasible in other OCS air permit applications to retrofit existing engines. USEPA Region 4 concurred SCR is technically infeasible for large internal combustion engines and third-party engines as described in the Preliminary Determination and Statement of Basis for Anadarko Petroleum, Inc. EGOM Drilling Project, stating: *This option is technically infeasible due to limited space availability for the SCR unit itself as well as the necessary ancillary equipment (e.g., urea storage tanks). In addition, the variable loads of the main diesel engines cannot maintain the required temperature for the catalyst to work. The emergency diesel engine, third party engines, and the stimulation vessel pumps would not operate for time periods long enough for the catalyst to reach the necessary working temperature*. Similar reasons were given in the Cape Wind OCS air permit application, as described in the Vineyard Wind permit application.

4.4.8.2 Selective Non-catalytic Reduction (SNCR)

SNCR is technically infeasible because the vessel engines would operate at temperatures lower than the SNCR required operating temperature, which ranges from 1,550 and 1,950 °F.

4.4.8.3 4-way Catalytic Converter

This technology operates best at steady state loads and exhaust temperatures. Additionally, non-combustible elements present in engine lube oils may collect over time and damage the catalyst. Finally, this technology is still in the development stage and is not available for marine diesel engines.

As described above, no add-on technologies were identified as technically feasible for marine engines. Furthermore, use of these technologies would require US Wind to wait for a vessel with this technology installed or require third-party contractors to replace old engines or retrofit existing engines with add-on controls. None of these options are feasible for reasons described below.

It is not technically feasible to slow down, delay, or extend the Project's construction schedule to allow use of a vessel with lower NO_x emissions. It is also not technically feasible to limit the pool of vessel engines to those meeting Tier 3 (Category 3 engines) or Tier 3 or 4 (Category 1 and 2 engines) standards. US Wind must be able to draw vessels from the existing fleet of vessels as needed to meet project demands during construction, commissioning, and O&M periods. Consequently, the pool of third-party engines that could potentially become regulated as OCS sources due to anchoring or attaching to an OCS source is undefined. Thus, it would not be possible to ensure Tier 4 vessel emissions for all construction and O&M vessels. As such, it is not possible for all engines to be equipped with the NO_x emissions control technology such as SCR as these add-on controls were determined to be infeasible for the Project.

The feasible NOx control technologies ranked in order of effectiveness (from most effective to least effective) are as follows:

- Engine Design/Combustion Design
- Good Combustion Practices

All of these technologies have been used to reduce NO_x emissions from diesel-fired engines and all of these technologies are listed in the RBLC database and recent LAER determinations for offshore wind Projects. An engine design certified by the manufacturer to meet the NSPS regulations would have incorporated good combustion design, which would lead to good combustion practices. Good engine design might entail the use of turbocharging and aftercooling to meet the regulatory emission standards.

4.4.9 LAER Determination for NOx

US Wind has provided in Appendix E a set of proposed testing, monitoring, record keeping, and reporting requirements that will allow for practicable enforcement of the following LAER determination.

4.4.9.1 Vessels

The offshore wind installation industry is unique in that LAER is being applied to vessels that are temporarily supplied by third-party contractors. Additionally, the construction schedule for a large offshore wind project is complex and subject to change with little notice. Therefore, US Wind cannot identify specific individual marine engines that would be the OCS sources subject to NNSR and required to comply with LAER.

LAER for the engines used during the construction and O&M phases is considered to be engine design and good combustion practices. LAER should include work practices such as reduced idling when possible, using low-sulfur fuel oil, conducting regular maintenance on the engines, and using engines meeting USEPA certification or International Maritime Organization standards, where possible. This is supported by the findings in the RBLC database search results, where it showed BACT/LAER for engines was the use of good combustion practices and generally following the NSPS emission standards for engines included in 40 CFR 60 Subpart IIII.

As discussed earlier, US Wind must maintain a reasonable degree of flexibility regarding final design and construction and O&M logistics in regard to the vessels and thus, the associated diesel engines subject to a LAER assessment. As such, US Wind is not able to identify the specific individual marine diesel engines that would be the OCS sources subject to LAER.

US Wind has determined the following as not feasible as LAER for NO_X:

- It is not feasible for US Wind to modify, delay or extend the Project's construction schedule to wait for a vessel with lower NO_x emissions to become available.
- It is not feasible for US Wind to limit the pool of potential engines on jack-up vessels to those meeting Tier 3 (Category 3) or Tier 3 or 4 (Category 1 and 2) standards because of the very limited pool of jack-up vessels available worldwide that can construct the Project.
- It is not feasible for US Wind to place restrictions on vessels that could become OCS sources if they anchor or attach to OCS sources while performing work. US Wind has not specifically anticipated the use of such vessels but cannot rule out their potential use. The specific vessels which could anchor or attach to an OCS source could easily change with little notice because of variable availability and limitations associated with the Jones Act. Numerous other offshore wind projects are scheduled to be constructed at the same time as US Wind and would be drawing from the same supply of vessels as US Wind. US Wind cannot feasibly limit the pool of third-party vessels while maintaining the Project's construction schedule.
- The LAER determination treats foreign-flagged vessels differently than U.S.-flagged vessels (other than foreign-flagged vessels that meet the definition of a work boat or crew and supply vessel as defined in 17 CCR Part 93118.5) because foreign-flagged vessels are not required to comply with 40 CFR Part 1042.101. Foreign vessels are only required to comply with 40 CFR Part 1043, which require engines over 130 kW on foreign-flagged vessels to have a valid certification that the engine(s) meet the applicable emission standards of IMO Annex VI for engines on Party vessels and evidence of conformity with Regulation 13 of Annex VI for engines installed on non-Party vessels.
- Finally, the LAER determination groups Category 3 engines on domestic vessels with foreign-flagged vessels (all engines) not meeting the definition of a work boat, or crew and supply vessel for the following reasons:
    - Category 3 engines are not required to comply with 17 CCR Part 93118.5 since they meet the definition of *ocean-going vessel*, which are not subject to the rule; and
    - There are no Tier 4 emission standards in 40 CFR Part 1042 for Category 3 engines.

The following represents feasible control methods and are considered as LAER for the Project OCS sources:

- US Wind would use jack-up vessels when considered as OCS sources, with engines that meet Tier 2 or better marine emission standards.
- If crew and supply vessels become OCS sources by tethering to an OCS source (i.e., WTG or OSS), US Wind would restrict those vessels to those containing Tier 2 or higher engines. These vessels, foreign and domestic, that meet the definition of work boat or crew and supply vessel, as defined in 17 CCR Part 93118.5, and are OCS sources, which have Category 1 and 2 engines would meet marine engine Tier 2 (40 CFR Part 1042 Appendix I) or better (Tier 4 or Tier 3 in 40 CFR Part 1042.101) emission standards. The proposed LAER determination would only apply to vessels that are considered OCS sources (i.e., it would not apply to a crew transfer vessel that does not meet the definition of an OCS source, even if the crew transfer vessel meets the definition of a crew vessel as defined in 40 CFR Part 1042.101).
- All engines on primary crew transfer vessels would meet the highest Tier standard for marine engines in 40 CFR Part 1042.101. Tier 4 emission standards apply to engine(s) at or above 600 kW and Tier 3 emission standards apply to engine(s) below 600 kW. The primary crew transfer vessels are different than all of the other vessels in the construction, commissioning, and O&M phases because they would be needed on a daily basis. Therefore, as described in the BACT determination section of the fact sheet accompanying the South Fork OCS Air Permit, "The use of the highest tiered engine at the 'time of deployment' identified as the option for BACT for vessel engines other than the primary crew transport vessel does not apply to the primary crew transport vessel which would be used on an almost daily basis for the entire life of the [Project]".
- All other domestic vessels that may become OCS sources via anchoring or tethering to OCS sources would have engines that are certified by the manufacturer to be in compliance with applicable USEPA marine diesel standards. Domestic vessels that do not meet the definition of work boat or crew and supply vessel, as defined in 17 CCR Part 93118.5, and are OCS sources, which have Category 1 and 2 engines would meet marine engine Tier 1 (40 CFR Part 1042 Appendix I) or better (Tier 2 in 40 CFR Part 1042 Appendix I, Tier 3 or Tier 4 in 40 CFR Part 1042.101) emission standards.
- All engines on foreign vessels that do not meet the definition of work boat or crew and supply vessel, as defined in 17 CCR Part 93118.5, and are OCS sources, would meet marine engine Tier 1 (40 CFR Part 1042 Appendix I for Category 1 and 2 engines or 40 CFR Part 1042.104 for Category 3 engines) or better (Tier 2 in 40 CFR Part 1042 Appendix I, Tier 3 or Tier 4 in 40 CFR Part 1042.101 for Category 1 and 2 engines, or Tier 2 or 3 in 40 CFR Part 1042.104 for Category 3 engines) or IMO Tier 1 or better (IMO Tier 2 or Tier 3) emission standards.
- All Category 3 engines on domestic vessels that are OCS sources would meet marine engine Tier 1 (40 CFR Part 1042.104) or better (Tier 2 or Tier 3 in 40 CFR Part 1042.104) or IMO Tier 1 or better (IMO Tier 2 or Tier 3) emission standards.
- US Wind would require through its specification and procurement process that its contractors and subcontractors use diesel marine engines that meet applicable USEPA standards. Lastly, US Wind proposes a federally enforceable total NO_x emissions limit

for the construction period and an annual NO_x emissions limit for O&M period based on the Project's estimate of potential emissions as LAER. To track compliance with the permitted annual emission limits, US Wind would record the fuel usage and/or operating hours of all vessels and equipment.

4.4.9.2 OSS Generators

Internal combustion engines (i.e., generating sets) located on the OSS are required to meet the USEPA NSPS at 40 CFR Part 60, Subpart IIII to the extent that the stationary source regulations are applicable. For the purposes of determining which emission limit is applicable to these internal combustion engines, the date that construction commences is the date the engine is ordered by the original owner or operator. US Wind assessed the differences between operative federal regulations for ICE including: a Tier 3 and Tier 4 engine in 40 CFR part 60, Subpart IIII, 40 CFR Part 89, 40 CFR Part 1039, and 40 CFR Part 1042.

Operative regulations:

- 40 CFR Part 89 - Control of Emissions From New And In-Use Nonroad Compression-Ignition Engines
- 40 CFR Part 1039 - Control of Emissions From New And In-Use Nonroad Compression-Ignition Engines
- 40 CFR Part 1042 - Control of Emissions From New And In-Use Marine Compression-Ignition Engines And Vessels

The NSPS subpart IIII regulation allows non-emergency engines being installed on marine offshore installations to meet the emission standards in either: Section 60.4201(a) or in Section 60.4201(f). Section 60.4201(a) requires Tier 4 standards for new non-emergency engines under Part 1039. Section 60.4201(f) requires applicable Tier standards from Part 1042 depending on the engine size and model year. Based on recent LAER determinations for offshore wind projects and a review of the relevant regulations, the lowest emitting diesel-fired electric generators are generators certified to the highest Tier standard in 40 CFR Part 1039 (i.e., Tier 4).

For the diesel-powered electric generators on the OSSs, the proposed LAER is:

- Use of good combustion practices,
- Reduce idling where possible,
- Use of ultra-low sulfur distillate fuel, and
- Tier 4 engine emission requirements in 40 Part 1039.

4.5 BACT Analysis for Carbon Monoxide (CO)

4.5.1 *Identify Potential Control Technologies for CO*

To identify potential control technologies or techniques for CO, the USEPA's RBLC for emission sources like those included in the Project was searched. Copies of the search results are found in Tables 4-1 through 4-6.

The RBLC summarizes the source, the emission limit, and the type of emission limit. The RBLC was searched for the last ten years from the following process categories:

- Large Internal Combustion Engines (> 500 hp) – Fuel Oil (Process Type 17.110);
- Small Internal Combustion Engine (< 500 hp) – Fuel Oil (Process Type 17.210); and
- Misc. Internal Combustion Engines (Process Type 19.800)

In addition to a search of the USEPA's RBLC, the following data sources were assessed:

- California Air Resource Board BACT Clearinghouse
- USEPA Regulatory Impacts Analyses - *Regulatory Impact Analysis: Control of Emissions of Air Pollution from Category 3 Marine Diesel Engines* (EPA-420-R-09-019, December 2009) and *Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder* (EPA-420-R-08-001, March 2008).
- Recent OCS Air Permit/PSD permits issued by the USEPA and their associated Statement of Basis

Potential add-on emission control technologies and emission reduction techniques for CO are reviewed below. The technical feasibility of applying control technologies and techniques to the emission sources included in the Project are addressed in further detail in the following sections of this analysis. There are several demonstrated methods available for controlling CO emissions including the methods listed below.

- Diesel Oxidation Catalyst
- 4-Way Catalytic Convertor
- Good Design and Operating Practices.

4.5.2 *Recent BACT Determinations*

US Wind reviewed numerous USEPA air permits, their associated Statement of Basis, and related application materials for sources similar to the marine diesel engines proposed for the US Wind Project. During this review, US Wind found only two (2) OCS air permits that included a BACT determination for CO. The Projects were the Vineyard Wind 1 Project (USEPA Permit Number OCS-R1-03-M1) and the South Fork Wind Project (EPA Permit Number OCS-R1-04). The Vineyard Wind 1, LLC OCS air permit was issued on August 19, 2022 for the installation and operation of an 800 MW offshore wind energy project in the Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0501.

The South Fork Wind Farm OCS permit was issued on January 18, 2022 for the installation and operation of a 130 MW windfarm in the Rhode Island-Massachusetts Wind Energy Area.

The LAER determinations for NO_x in the OCS air permits reviewed were also considered BACT for CO. The Vineyard Wind and South Fork permit conditions described in Section 4.2.2 that were considered LAER for NOx were also considered BACT for CO.

4.5.3 Change in Raw Materials

The same raw material changes used to evaluate LAER for NO_x were used to evaluate BACT for CO. The raw materials are identified in Section 4.4.3.

4.5.4 Process/Operation Modifications

The discussion in Section 4.4.4 for NO_x emissions is also applicable to CO emissions.

4.5.5 Aftertreatment Control Technologies

The following Sections discuss emission control technologies that involve the use of aftertreatment devices, which are placed in an engine's exhaust system.

4.5.5.1 Diesel Oxidation Catalyst

Diesel oxidation catalysts (DOC) are flow-through devices containing a catalytic coating that oxidize CO, gaseous hydrocarbons, and liquid hydrocarbon particles, thus lowering PM and CO emissions. Depending on the exhaust temperature and the catalyst, DOC may oxidize SO_2 to sulfate PM, lowering the effectiveness of the control technology for PM. DOC is efficient at temperatures at or above 250 °C.

4.5.5.2 4-Way Catalytic Converter

A 4-way catalytic converter can simultaneously reduce emissions of CO, HC, NOx, and PM on a single support. 4-way catalytic converters can enable diesel engines to meet stringent emission limitations while minimizing the space needed for post-combustion treatment systems

4.5.6 CO Limits in State Implementation Plans

The limits in California's SIP apply to CO as well as NO_x, with the same general requirements (see Section 4.4.7). The NSPS and NESHAP identified in Section 4.3 and 4.4.7 for NO_x are applicable to CO emissions as well.

4.5.7 Feasibility Analysis of CO Control Technology

The feasibility of each control systems identified in Sections 4.5.3 through 4.5.5 is addressed below.

Add-on controls remove emissions after they have been generated by a process. In this case, add-on controls would remove emissions from the internal combustion engine exhaust stream. No verified CO add-on control technologies for marine internal combustion engines were identified in a review of the USEPA Verified Technologies List and the California Air Resources Board Verified Technologies List. US Wind identified several potential add-on control technologies to reduce CO emissions that could be implemented by vessel or marine engine manufacturers during initial construction or retrofitted. These technologies are described in Section 4.5.5 and include:

- Diesel Oxidation Catalyst
- 4-way Catalytic Converter
- Good design and operation practices

None of these technologies are considered technically feasible for the reasons listed below:

4.5.7.1 Diesel Oxidation Catalyst

Diesel oxidation catalysts require sufficient exhaust temperatures sustained for long periods of time to facilitate regeneration of HC compounds by the catalyst. USEPA determined that marine vessel engines cannot sustain the required temperatures for high catalyst performance because of their variable loads. Non-combustible elements present in engine oils may collect over time and damage the catalyst. Additionally, this technology can cause pressure drop across the exhaust flow, resulting in back pressure on the engine that can cause plugging of the engine, which is a safety concern. For these reasons, a diesel oxidation catalyst is not technically feasible to reduce CO emissions.

4.5.7.2 4-way Catalytic Converter

Four-way catalytic converters require sufficient exhaust temperatures sustained for long periods of time to facilitate regeneration of HC compounds by the catalyst. USEPA determined that marine vessel engines cannot sustain the required temperatures for high catalyst performance. Non-combustible elements present in engine oils may collect over time and damage the catalyst. Additionally, US Wind is not aware of any instances where this technology has been designed for or tested on a commercially available marine internal combustion engine.

4.5.7.3 Good Design and Combustion Practices

Good design and combustion practices is a feasible control method for the emergency/backup diesel engines. Complying with the applicable NSPS regulations (i.e., 40 CFR 60, Subpart IIII) and applicable marine engine regulations, would ensure that the generators and vessels meet good design and operating standards.

4.5.7.4 Process/Operation Modifications

Process and operational modifications are discussed in detail in Section 4.4.4. For the engines that are expected to be used for the Project construction, commissioning, and O&M, process modifications are intrinsic to the design of the engine. As such, process modifications are addressed by acquiring engines that meet the applicable engine certification standards.

4.5.8 BACT Determination for CO

US Wind has provided in Appendix E a set of proposed testing, monitoring, record keeping, and reporting requirements that will allow for practicable enforcement of the following BACT determination.

Based on the analysis in this section, US Wind proposes to use stationary internal combustion engines that meet the Tier 4 emission standards as BACT for non-emergency diesel generators on the OSSs. The non-emergency diesel generators on the OSSs would be USEPA certified non-road engines that meet the most stringent USEPA Tier standards for engines firing ULSD found at 40 CFR 60 Subpart IIII, which direct the reader to Tier 4 emission standards at 40 CFR 1039. These are the cleanest available units in general production for the sizes required by this project. The most stringent USEPA Tier limits are USEPA Tier 4 certified engines (40 CFR Part 1039), which inherently contain pollution control devices/designs to meet the stringent emission standards.

The proposed BACT control methods discussed in Section 4.4.9 for NOx are also applicable to and proposed as BACT for CO control.

US Wind would require through its specification and procurement process that its contractors and subcontractors use diesel marine engines that meet applicable USEPA standards. Lastly, US Wind proposes a federally enforceable total CO emissions limit for the construction period and an annual CO emissions limit for O&M period based on the Project's estimate of potential emissions as BACT. To track compliance with the permitted annual emission limits, US Wind would record the fuel usage and/or operating hours of all vessels and equipment.

4.6 BACT Analysis for Particulate Matter (PM), PM10, and PM2.5

4.6.1 Identify Potential Control Technologies for PM, PM10, and PM2.5

To identify potential control technologies or techniques for particulates, the USEPA's RBLC was searched for emission sources like those included in the Project. Copies of the search results are found in Tables 4-1 through 4-6. Additionally, a review was conducted of the control techniques discussed in USEPA's AP-42, and permits issued to similar operations.

Based on the results of the RBLC searches and review of permits issued to similar OCS Wind Projects, the following control options were assessed.

- Use of certified engine/compliance with NSPS standards
- Good combustion practices
- Proper engine design
- Use of clean fuels
- Installation of diesel particulate filter
- Diesel oxidation catalysts

Potential add-on emission control technologies and emission reduction techniques for PM, PM10, and PM2.5 are reviewed below. The technical feasibility of applying control technologies and techniques to the emission sources included in the Project are addressed in further detail in the following sections of this analysis.

4.6.2 Change in Raw Materials

Project-related emissions that are from OCS sources are from compression-ignition internal combustion engines. Particulate matter emissions from diesel fired internal combustion engines may result from trace metals present in the fuel, unburned carbon-containing materials, and sulfate formation. Good combustion practices and use of clean fuels are the methods currently utilized to minimize PM, PM10, and PM2.5 emissions from diesel engines. As such, the use of clean fuels is assessed as Step 1 of the BACT analysis. Most marine vessels operate on liquid petroleum fuel (either marine distillate or marine residual oil). These, and other, fuel types are described and reviewed in this section.

4.6.2.1 Marine Distillate Fuel

Marine distillate is a type of liquid petroleum fuel and is similar to the fuel used in diesel trucks and diesel nonroad construction equipment. Marine distillate is created using the same basic distillation process used to create other liquid fuels like motor gasoline and heating oil. Marine distillate is divided into four fuel types: DMX, DMA, DMB, and DMC. DMA and DMB, also known as Marine Gas Oil (MGO) and Marine Diesel Oil (MDO), respectively, are the most commonly used marine distillate fuels. MGO is a clear, light distillate product with a relatively high cetane value and density. MGO must contain no traces of residual fuel. MGO is typically used in small to medium-sized marine vessels (mostly Category 1 engines) and for emergency and auxiliary engines on larger vessels. MDO is generally created by blending distillate fuel with residual fuel oil, which raises the fuel's sulfur content. MDO is mostly used in Category 2 and 3 engines.

4.6.2.2 Marine Residual Fuel

Residual fuel (which includes Heavy Fuel Oil (HFO), bunker fuel, #6 oil, or Intermediate Fuel Oil (IFO)) is relatively inexpensive and has a high energy content. Residual fuel alone is not typically used in marine engines due to its high viscosity. IFO, which is residual fuel blended with lighter components, is the most commonly used fuel in the marine transportation industry.

Residual fuel comes from the refined by-products of typical petroleum distillation. The dense, viscous fuel typically consists of residual high-molecular weight hydrocarbons and often contains contaminants such as water, sulfur compounds, and heavy metals. Residual fuel contains significantly more sulfur than distillate fuel. The sulfur compounds are primarily emitted as SO_2, but a small fraction of the sulfur is converted into SO_3, which forms sulfate (a form of PM). High-molecular weight organic and metals compounds agglomerate and form PM. Consequently, combustion of residual fuel results in higher PM emissions, relative to combustion of distillate fuel.

4.6.2.3 Ultra-Low Sulfur Diesel (ULSD) Fuel

Ultra-low sulfur diesel (USLD) is distillate fuel with a sulfur content specification of less than 15 ppm. ULSD used for automotive diesel engines is similar to that used for marine engines.

4.6.2.4 Natural Gas

Natural gas is primarily composed of methane (CH_4), which is a nontoxic and flammable gas. Liquefied Natural Gas (LNG) is created by cooling natural gas below its boiling point. Liquefying natural gas reduces the volume of the gas by a factor of about 600, which makes it significantly easier to transport and store. Compressed natural gas (CNG) is created by compressing natural gas from a utility pipeline at about 100 – 500 psi to a much higher pressure, reducing its volume by a factor of ten or more. Compared to light fuel oil, use of natural gas can reduce SO_2, PM, NO_x, and CO_2 emissions.

4.6.2.5 Liquefied Petroleum Gas (LPG)/Propane.

Liquefied Petroleum Gas (LPG) primarily consists of propane and butane, along with some propylene and other light hydrocarbons. These light hydrocarbons are gaseous under normal atmospheric conditions but can be liquefied under moderate pressure. LPG is predominantly produced form natural gas processing but is also produced from oil refining. LPG is stored under pressure in tanks or cylinders. The use of LPG as a fuel results in very low SO_2 and PM emissions.

4.6.2.6 Biodiesel

Biodiesel is a renewable fuel derived from animal fats and vegetable oils. Animal fats and plant oils are reacted with alcohols to produce a fuel with characteristics similar to diesel. Use of pure biodiesel (B-100) in diesel engines requires major engine modifications. Use of a blend of 20% biodiesel and 80% diesel fuel (B-20) does not require engine modifications. Compared to traditional liquid petroleum fuels, use of B-20 can reduce PM emissions, but can increase NOx emissions.

4.6.2.7 Methanol

Methanol (CH_3OH) is a type of liquid alcohol fuel. Methanol has lower energy content than traditional fuels. Consequently, the space needed to store methanol in a tank is approximately double that of traditional diesel fuels. Most methanol on the market is produced from natural gas, but it can also be produced from renewable raw materials. Methanol does not contain sulfur and therefore combustion of methanol does not produce sulfur oxide emissions. Methanol combustion also produces low emissions of PM.

4.6.3 Process/Operation Modifications

In addition to add-on controls, inherently lower-emitting processes/practices/designs are assessed within a BACT analysis. Given the unique nature of constructing the project compared to typical stationary sources subject to NSR, the use of the highest tiered engine (this results in the lowest overall emissions of regulated NSR pollutants available at the "time of deployment" is identified as the option for BACT for vessels operating as OCS sources, as a work practice standard. Time of deployment is impacted by several factors, including but not limited to, construction timetable and contractual obligations. Thus, it is challenging to secure experienced installation contractors and offshore components, and finding the vessels needed for a windfarm of this size and complexity at the time they are needed to meet established construction schedules is difficult. In addition, construction of the facility would utilize European vessels and installation equipment, which often has limited availability.

Therefore, in Step 1 of BACT for vessels operating as OCS sources, a significant factor is that engines must be available to US Wind for construction to proceed. A detailed discussion of US Wind's assessment of inherently lower emitting process is provided in Section 4.4.4 that is also applicable to PM emissions.

4.6.4 Aftertreatment Control Technologies

4.6.4.1 Oxidation Systems

Oxidation refers to the combustion of organic compounds at a sufficiently high temperature and adequate residence time. Oxidation systems can be categorized as either thermal or catalytic. Although primarily used for VOC control, oxidation systems also can remove organic particulate matter from air streams. These systems are most suitable for exhaust streams in which the particulates are primarily condensable. In oxidation systems, the heat recovery beds are heated such that they are hotter than the incoming gas stream. This results in condensable particulates re-evaporating upon entering the bed. Removal efficiencies for condensable particulates can be as high as 90%. However, oxidation systems are not very well suited for gas streams with high levels of filterable particulate matter without the gas stream undergoing pretreatment. Catalytic oxidizers use a bed of catalyst that facilitates the overall combustion of combustible gases. High levels of particulates, including filterable and condensable, in an exhaust stream can mask the catalysts used in these systems and would routinely plug and foul the equipment. In a thermal oxidation system, combustible materials in an exhaust stream are oxidized by increasing the temperature of the material above its auto-ignition point in the presence of oxygen; the high temperature is maintained for enough time so all pollutants complete combustion to carbon dioxide and water. As with catalytic oxidizers, excessive amounts of particulate matter in the incoming emission stream can lead to fouling and plugging of media beds within the system. In general, catalytic systems do not provide higher control efficiencies than other combustion control technologies.

Therefore, as a form of particulate matter control, oxidation systems are best suited for emission streams comprised primarily of condensable particulates, for low level particulate matter emission streams, or for systems with additional upstream particulate control.
Diesel oxidation catalysts (DOC) are flow-through devices containing a catalytic coating that oxidize CO, gaseous hydrocarbons, and liquid hydrocarbon particles, thus lowering PM and CO emissions. DOC is efficient at temperatures at or above 250 °C.

4.6.4.2 Diesel Particulate Filter (DPF)/Catalytic Diesel Particulate Filter (CDPF)

Diesel particulate filters (DPF) are the most effective exhaust aftertreatment used for control of diesel engine PM emissions. DPF are wall-flow filter devices that physically trap fine PM by forcing the engine exhaust through a porous media with extremely small openings and long pathways. Additional pumping work is required to force the engine exhaust through the porous medium, which, depending on the operating load, can result in higher fuel consumption. In a DPF, the collected PM is actively oxidized; high temperature exhaust gas, a fuel burner, or an electric heater is used to increase the temperature of the filter so that PM can be oxidized. The exhaust gas must reach approximately 500 °C in a DPF.

Catalytic diesel particulate filters (CDPF) are passive devices containing catalysts that oxidize PM. CDPF require lower temperatures than DPF (200 °C – 300 °C). However, at higher exhaust temperatures, CDPF can oxidize SO_2 to sulfate PM, reducing the effectiveness of the control technology. CDPF can also catalytically oxidize CO and VOC, provided that the exhaust temperature is sufficient enough to facilitate regeneration of the catalyst.

4.6.5 Feasibility Analysis of PM Control Technologies

As discussed in Sections 4.6.1 through 4.6.4, the following particulate control methods were identified for diesel fired engines:

- Use of certified engine/compliance with NSPS standards
- Good combustion practices
- Proper engine design
- Use of clean fuels
- Installation of diesel particulate filter
- Diesel oxidation catalysts

The feasibility of each of these methods is discussed below.

4.6.5.1 Change in raw materials – Clean Fuels

For diesel generators and non-road engines, the "raw material" is a fuel that would be combusted for the generation of electricity or mechanical energy. The fuel used by the engine must be readily available, able to be stored locally, and fired without the need for external energy input as the engines would be located away from any pipeline fuel supplies. This requirement limits the potential fuels to ULSD and LPG/propane. There may be unresolvable safety issues regarding bulk propane/LPG handling while commissioning an OSS over water. Handling a fuel that generates flammable and explosive vapors while high-voltage equipment is being tested has inherent fire safety risks that could be impossible to mitigate. Thus, the use of marine diesel and ULSD was selected as the only feasible fuels.

4.6.5.2 Good Design and Combustion Practices and Proper Engine Design

Good design and combustion practices is a feasible control method for the emergency/backup diesel engines. Complying with the applicable federal regulations would ensure that the vessels when they are OCS sources and the generators on the OSS meet good design and operating standards.

4.6.5.3 Process/Operation Modifications

Process and operational modifications are discussed in detail in Section 4.5.4. For the engines that are expected to be used for the Project construction, commissioning, and O&M, process modifications are intrinsic to the design of the engine. As such, process modifications are addressed by acquiring engines that meet the applicable engine certification standards.

4.6.5.4 Add-On Controls - Stationary Diesel Engines

Internal combustion engines located on an OSS are required to meet 40 CFR Part 60, subpart IIII to the extent that the stationary source regulations are applicable. For the purposes of determining which emission limit is applicable to these internal combustion engines, the date that construction commences is the date the engine is ordered by the original owner or operator. For the internal combustion engines proposed for the OSS, the differences between a Tier 3 and Tier 4 engine in 40 CFR Part 60, subpart IIII, 40 CFR Part 1039, and Part 1042 were assessed. The lowest emitting diesel-fired electric generators are generators certified to the highest Tier standard in 40 CFR Part 1039.

The NSPS rule allows non-emergency engines being installed on marine offshore installations to meet the emission standards in either: Section 60.4201(a), which requires Tier 4 standards for new non-emergency engines under Part 1039, or in Section 60.4201(f), which requires applicable Tier standards from Part 1042 depending on the engine size and model year.

The Tier 3 standards for domestic marine vessel engines are based on engine manufacturers' capabilities to reduce particulate matter (PM) and oxides with recalibration and other engine-based technologies. The Tier 4 engine standards require the use of exhaust aftertreatment technology, phased in from 2014 to 2017, depending on engine power. The 600 kW threshold for applying the Tier 4 standards is intended to avoid aftertreatment-based standards for small vessels used for certain applications that were most likely to be designed for high-speed operation with very compact engine installations. Many of the technologies identified as part of the BACT analysis affect the actual design of the diesel-fired electric generator. The USEPA recognized this fact in the NSPS for stationary compression ignition internal combustion engines by requiring standards for manufactures to meet. Therefore, a manufacturer of a Tier 3 or Tier 4 engine would incorporate technically feasible emission reduction technology into the engine's design. For example, a Tier 4 engine typically a diesel particulate filter in combination with a diesel oxidation catalyst to reduce fine particulates. In other words, the pollution control equipment becomes an integral part of the overall engine, and accordingly, any additional pollution control equipment beyond that already implemented by an engine manufacturer to meet NSPS requirements is considered infeasible.

4.6.5.5 Add-on Controls - Vessel Engines

For construction and O&M of the Project, US Wind would use a fleet of industry-ready marine vessels. Process and operational modifications are discussed in detail in Section 4.4.4 and the conclusions of that analysis for NO_x emissions also apply to PM emissions. The vessel needs for installation of WTGs and the OSSs change on short notice and require contracts with third-party construction companies within short timeframes. All internal combustion engines operated on OCS vessels would be operated by third parties, i.e., not by US Wind. Therefore, the size and installation date of the engines are unknown. US Wind has reviewed the technical feasibility of different add-on control technologies and has determined that add-on controls are technically infeasible due to the unique considerations related to contracting vessels for this type of project as well as due to space constraints on the vessels. The feasible alternative is to allow construction to proceed while ensuring use of the cleanest engines available at the "time of deployment".

4.6.6 BACT Determination for PM, PM10, and PM2.5

US Wind has provided in Appendix E a set of proposed testing, monitoring, record keeping, and reporting requirements that will allow for practicable enforcement of the following BACT determination.

Based on the analysis in this section, US Wind proposes to use non-marine stationary internal combustion engines that meet the Tier 4 emission standards as BACT for non-emergency diesel generators on the OSSs. The non-emergency diesel generators on the OSSs would be USEPA certified non-road engines that meet the most stringent USEPA Tier standards for engines firing ULSD found at 40 CFR 60 Subpart IIII, which direct the reader to Tier 4 emission standards at 40 CFR 1039. These are the cleanest available units in general production for the sizes required by this project. The most stringent USEPA Tier limits are USEPA Tier 4 certified engines (40 CFR Part 1039), which inherently contain pollution control devices to meet the stringent emission standards. Many engineer manufacturers design engines with diesel particulate filters for PM control.

BACT for the engines used during the construction and O&M phases is considered to be engine design and good combustion practices. BACT should include work practices such as reduced idling when possible, using low-sulfur fuel oil, conducting regular maintenance on the engines, and using engines meeting USEPA certification or International Maritime Organization standards, where possible. This is supported by the findings in the RBLC database search results, where it showed BACT for engines was the use of good combustion practices and generally following the NSPS emission standards for engines included in 40 CFR 60 Subpart IIII.

As discussed earlier, US Wind must maintain a reasonable degree of flexibility regarding final design and construction and O&M logistics in regard to the vessels and thus, the associated diesel engines subject to a BACT assessment. As such, US Wind is not able to identify the specific individual marine diesel engines that would be the OCS sources subject to BACT. For the overall construction of the windfarm to be feasible, US Wind would use the cleanest vessels available from the contractors at the “time of deployment” based on the availability of those vessels from the contractors US Wind retains.

The proposed BACT control methods discussed in Section 4.4.9 for NO_x are also applicable to and proposed as BACT for PM/PM10/PM2.5 control.

Lastly, US Wind proposes a federally enforceable total PM/PM10/PM2.5 emissions limit for the construction and commissioning period and an annual PM/PM10/PM2.5 emissions limit for O&M period based on the Project’s estimate of potential emissions as BACT. To track compliance with the permitted annual emission limits, US Wind would record the fuel usage and/or operating hours of all vessels and equipment during the Project.

Table 4-1. Recent RBLC Database for Large (>500 HP) Engines.

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
AL-0177	11/21/2022	11/21/2022	17.110	Diesel Emergency Engines	Diesel	NSPS	CO – 3.5 G/Kw-Hr NOx – 5.6 G/Kw-Hr TPM – 0.20 G/Kw-Hr PM10 – 0.20 G/Kw-Hr PM2.5 – 0.20 G/Kw-Hr SO2 – 15 ppmw Sulfur in fuel VOC – 0.80 G/Hp-Hr
IL-0133	07/29/2022	07/29/2022	17.110	Diesel Emergency Engines	Diesel	NSPS	CO – 3.5 G/Kw-Hr NOx – 6.4 G/Kw-Hr TPM – 0.20 G/Kw-Hr PM10 – 0.20 G/Kw-Hr PM2.5 – 0.20 G/Kw-Hr SO2 – 15 ppmw Sulfur in fuel
MI-0451	06/23/2022	06/23/2022	17.110	Diesel Emergency Engines	Diesel	NSPS	CO – 3.5 G/Kw-Hr NOx – 6.4 G/Kw-Hr TPM – 0.20 G/Kw-Hr PM10 – 0.20 G/Kw-Hr PM2.5 – 0.20 G/Kw-Hr SO2 – 15 ppmw Sulfur in fuel
TX-0933	11/17/2021	11/18/2021	17.110	Emergency Generator	Diesel	Limited to 100 hours per year of non- emergency operation EPA Tier 2 (40 CFR Part 1039.101) exhaust emission standards	None Listed

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
MI-0447	01/07/2021	9/10/2021	17.110	Emergency Engine	Diesel	ULSD Good combustion practices NSPS Compliant Catalytic oxidation was the control considered technically feasible. However, it was not considered economically feasible.	CO – 3.5 G/kW-Hr PM – 0.2 G/kW-Hr PM10 – 1.0 lb/hr PM2.5 – 1.0 lb/hr CO2e – 590 TPY 12-month rolling
TX-0911	12/15/2020	5/10/2021	17.110	Emergency Engine	ULSD	ULSD	None Listed
VA-0333	12/09/2020	5/19/2021	17.110	Emergency Engine Generator	Diesel	None Listed	PM10 – 1.1 lb/hr PM2.5 – 1.1 lb/hr CO2e – 2.543 lb/hr
AL-0328	11/09/2020	10/05/2021	17.110	Diesel Emergency Engines	Diesel	NSPS	CO – 2.6 g/bhp-hr NOx – 3.0 g/bhp-hr FPM – 0.15 g/bhp-hr SO2 – 15 ppm
LA-0383	09/03/2020	12/20/2021	17.110	Emergency Engines	Diesel	Comply with NSPS Subpart IIII	None Listed
AK-0085	08/13/2020	03/31/2021	17.110	Black Start Generator Engine	ULSD	Oxidation Catalyst Good combustion practices ULSD Limit operation to 500 hours per year	CO – 3.3 G/Hp-Hr NOx – 3.3 G/Hp-Hr TPM – 0.045 G/Hp-Hr PM10 – 0.045 G/Hp-Hr PM2.5 – 0.045 G/Hp-Hr SO2 – 15 ppmw Sulfur in fuel VOC – 0.18 G/Hp-Hr
TX-0888	04/23/2020	11/12/2020	17.110	Emergency Generators	ULSD	Well-designed and properly maintained engines Each limited to 100 hours per year of non- emergency use	None Listed

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KS-0040	12/03/2019	08/25/2020	17.110	Emergency Generator	Diesel	Emergency Diesel Engine Subject to NSPS Subpart IIII Combustion Control Limited Operating Hours	PM/PM10/PM2.5 - 0.2 G/kW-Hr
MI-0445	11/26/2019	12/23/2020	17.110	Emergency Generator	Diesel	Good Combustion Practices Meeting NSPS Subpart IIII requirements. Use of ULSD Restricted to 4 hours/day, except during emergency conditions and stack testing, and 500 hours/year on a 12-month rolling time period basis.	CO – 3.5 G/kW-Hr NMHC + NOx – 6.4 G/kW-Hr PM – 0.2 G/kW-Hr PM10/PM2.5 – 1.58 lb/hr CO2e – 928 tons/yr on a rolling 12- month basis
AR-0161	09/23/2019	5/5/2021	17.110	Emergency Engine	Diesel	Good Operating Practices Limited hours of operation Compliance with NSPS Subpart IIII	FPM/PM10/PM2.5 – 0.02 G/kW-Hr SO2 – 0.007 G/kW-Hr VOC – 1.9 G/kW-Hr CO – 3.5 G/kW-Hr NOx – 0.4 G/kW-Hr CO2e – 164 lb/MMBtu
OK-0181	09/11/2019	9/10/2021	17.110	Emergency Engine > 500 hp	Diesel	Good Combustion Practices Certified to meet USEPA Tier 3 engine standards. Gen-1 and FP-1 shall be limited to operate not more than 500 hours per year. SP-1 shall be limited to operate not more than 876 hours per year.	VOC – 3.0 G/kW-Hr

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
MI-0442	08/21/2019	8/9/2021	17.110	Emergency Engines	Diesel	Good combustion practices ULSD Compliance with NSPS IIII	NOx – 5.3 G/Hp-Hr CO – 0.15 G/Hp-Hr PM – 0.04 G/Hp-Hr PM10 – 7.85 lb/1000-gal hourly PM2.5 – 7.55 lb/1000-gal hourly VOC – 0.86 lb/hr CO2e – 444 tons/yr 12 month rolling
AR-0163	06/09/2019	11/10/2020	17.110	Emergency Engines	Diesel	Good Operating Practices Limited hours of operation Compliance with NSPS Subpart IIII ULSD	PM/PM10/PM2.5 – 0.2 G/kW-Hr SO2 - 0.0015 % Sulfur Fuel VOC – 1.55 G/kW-Hr CO – 3.5 G/kW-Hr NOx – 4.86 G/kW-Hr CO2 – 163 lb/MMBtu CH4 – 0.0061 lb/MMBtu N2O – 0.0013 lb/MMBtu
LA-0382	04/25/2019	12/16/2021	17.110	Emergency Engines	Diesel	Comply with standards of 40 CFR 60 Subpart IIII	None Listed
TX-0882	01/17/2020	11/12/2020	17.120	Emergency Engine	Diesel	Good combustion practices, Clean fuel ULSD 100 hours per year operating time	NOx – 0.0092 lb/MMBtu VOC – 0.001 lb/MMBtu CO – 0.0057 lb/MMBtu CO2e – 114.5 lb/MMBtu PM/PM10/PM2.5 – 0.0001 lb/MMBtu
AK-0084	06/30/2017	04/16/2020	17.110	Black Start & Emergency Engines	Diesel	Good Combustion Practices	NOx – 8 G/kW-Hr CO – 4.38 G/kW-Hr PM – 0.25 G/kW-Hr PM10 – 0.25 G/kW-Hr PM2.5 – 0.25 G/kW-Hr CO2e – 2781 TPY

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
AK-0084	06/30/2017	04/16/2020	17.110	Large ULSD/Natural Gas-Fired Internal Combustion Engines	Diesel and Natural Gas	Good Combustion Practices	VOC – 0.21 G/kW-Hr (USLD) & 0.09 G/kW-Hr (NG) NOx – 0.53 G/kW-Hr (USLD) & 0.08 G/kW-Hr (NG) CO – 0.18 G/kW-Hr (USLD) & 0.12 G/kW-Hr (NG) PM – 0.29 G/kW-Hr (USLD) & 0.13 G/kW-Hr (NG) PM10 – 0.29 G/kW-Hr (USLD) & 0.13 G/kW-Hr (NG) PM2.5 – 0.29 G/kW-Hr (USLD) & 0.13 G/kW-Hr (NG) FPM – 0.15 G/kW-Hr (USLD) & 0.0 G/kW-Hr (NG) CO2e – 1299630 TPY (USLD) & 869621 TPY (NG)
IL-0130	12/31/2018	04/16/2020	17.110	Emergency Engine	Ultra-Low Sulfur Diesel	None Listed	NOx – 6.4 G/kW-Hr CO – 3.5 G/kW-Hr TPM – 0.2 G/kW-Hr CO2e – 225 TPY
IN-0317	06/11/2019	05/26/2021	17.110	Emergency Generator	Diesel	Tier II diesel engine	NOx – 6.4 G/kW-Hr CO – 3.5 G/kW-Hr TPM – 0.2 G/kW-Hr PM10 – 0.2 G/kW-Hr PM2.5 – 0.2 G/kW-Hr SO2 – 15 ppm VOC – 6.4 G/kW-Hr CO2e – 881 TPY

KY-0109	10/24/2016	01/25/2021	17.110	Emergency Generator	Diesel	The permittee shall prepare and maintain for EU72, EU73, and EU74, within 90 days of startup, a good combustion and operation practices plan (GCOP) that defines, measures and verifies the use of operational and design practices determined as BACT for minimizing CO, VOC, PM, PM10, and PM2.5 emissions. Any revisions requested by the Division shall be made, and the plan shall be maintained on site. The permittee shall operate according to the provisions of this plan at all times, including periods of startup, shutdown, and malfunction. The plan shall be incorporated into the plant standard operating procedures (SOP) and shall be made available for the Division's inspection. The plan shall include, but not be limited to: i. A list of combustion optimization practices and a means of verifying the practices have occurred. ii. A list of combustion and operation practices to be used to lower energy consumption and a means of verifying the practices have occurred.	VOC – 4.77 G/Hp-Hr & 3.5 G/Hp-Hr CO – 2.6 G/Hp-Hr & 3.73 G/Hp-Hr FPM – 0.149 G/Hp-Hr & 0.298 G/Hp-Hr PM10 – 0.149 G/Hp-Hr & 0.298 G/Hp-Hr PM2.5 – 0.149 G/Hp-Hr & 0.298 G/Hp-Hr

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LA-0331	09/21/2018	6/19/2019	17.110	Large Emergency Engines	Diesel	Good Combustion and Operating Practices.	NOx – 5.6 G/kW-Hr CO – 3.5 G/kW-Hr TPM/PM10 – 0.2 G/kW-Hr PM2.5 – 0.2 G/kW-Hr SO2 – 0.0 Lb/Hp-Hr VOC – 0.79 G/kW-Hr CO2e – 1481 TPY
LA-0364	01/06/2020	08/09/2021	17.110	Emergency Generator	Diesel	Compliance with the limitations imposed by 40 CFR 63 Subpart IIII and operating the engine in accordance with the engine manufacturer's instructions and/or written procedures designed to maximize. combustion efficiency and minimize fuel usage.	None Listed
MA-0043	06/21/2021	08/09/2021	17.110	Cold Start Engine	ULSD	None Listed	NOx – 35.09 Lb/Hr CO – 2.2 Lb/Hr CO2e – 163.61 Lb/MMBtu & 3115 Lb/Hr SO2 – 0.029 Lb/Hr & 0.004 SA – 0.022 Lb/Hr & 0.003 Tons TPM10 – 0.4 Lb/Hr & 0.06 Tons TPM2.5 – 0.4 Lb/Hr & 0.06 Tons VOC – 0.85 Lb/Hr & 0.13 Tons
MD-0042	04/08/2014	08/12/2020	17.110	Emergency Engine	ULSD	Exclusive use of ULSD Good combustion practices Limited hours of operation Designed to achieve emission limits	NOx – 4.8 G/Hp-Hr SO2 – 0.006 G/Hp-Hr CO – 2.6 G/Hp-Hr FPM – 0.15 G/Hp-Hr PM10 – 0.15 G/Hp-Hr PM2.5 – 0.15 G/Hp-Hr

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MI-0441	12/21/2018	08/09/2021	17.110	Emergency Engines	Diesel	Good combustion practices NSPS compliant	NOx – 6.4 G/Hp-Hr CO – 3.5 G/Hp-Hr CO2e – 406 TPY PM10 – 0.69 G/Hp-Hr PM2.5 – 0.69 G/Hp-Hr
MI-0441	12/21/2018	08/09/2021	17.110	Emergency Engines	Diesel	Good combustion practices NSPS compliant	NOx – 6.4 G/Hp-Hr CO – 3.5 G/Hp-Hr CO2e – 1590 TPY PM10 – 2.7 G/Hp-Hr PM2.5 – 2.7 G/Hp-Hr
OH-0363	11/05/2019	04/01/2019	17.110	Emergency Engines	Diesel	ULSD Purchased certified to the standards in NSPS Subpart IIII	NOx – 13.74 Lb/Hr & 3.44 TPY CO – 8.57 Lb/Hr & 2.14 TPY CO2e – 433.96 TPY & None Listed TPM10 – 0.49 Lb/Hr & 0.12 TPY TPM2.5 – 0.49 Lb/Hr & 0.12 TPY VOC – 1.93 Lb/Hr & 0.12 TPY
OH-0363	11/05/2019	04/01/2019	17.110	Emergency Engines	Diesel	Emergency operation only < 500 hours/year each for maintenance checks and readiness testing Designed to meet NSPS Subpart IIII	NOx – 29.01 Lb/Hr & 7.25 TPY CO – 8.49 Lb/Hr & 2.12 TPY CO2e – 474 TPY TPM – 0.77 Lb/Hr & 0.19 TPY TPM10 – 0.77 Lb/Hr & 0.19 TPY TPM2.5 – 0.77 Lb/Hr & 0.19 TPY
OH-0363	08/25/2015	06/19/2019	17.110	Emergency Engines	Diesel	State-of-the-art combustion design	NOx – 21.6 Lb/Hr & 5.41 TPY CO – 13.5 Lb/Hr & 3.37 TPY CO2e – 683 TPY VOC – 3.1 Lb/Hr & 0.76 TPY TPM10 – 0.77 Lb/Hr & 0.19 TPY TPM2.5 – 0.77 Lb/Hr & 0.19 TPY

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OH-0637	09/23/2016	06/19/2019	17.110	Emergency Generator	Diesel	State-of-the-art combustion design	NOx – 27.18 Lb/Hr & 6.8 TPY CO – 16.96 Lb/Hr & 4.24 TPY CO2e – 858 TPY VOC – 3.84 Lb/Hr & 0.96 TPY SO2 – 0.03 Lb/Hr & 0.01 TPY TPM10 – 0.97 Lb/Hr & 0.24 TPY TPM2.5 – 0.97 Lb/Hr & 0.24 TPY
OH-0368	04/19/2017	06/19/2019	17.110	Emergency Generator	Diesel	Good combustion control and operating practices and engines designed to meet the stands of 40 CFR Part 60, Subpart IIII	NOx – 5.5 Lb/Hr & 0.3 TPY CO – 28.8 Lb/Hr & 1.4 TPY CO2e – 1289 TPY VOC – 1.6 Lb/Hr & 0.08 TPY TPM10 – 0.2 Lb/Hr & 0.01 TPY TPM2.5 – 0.2 Lb/Hr & 0.01 TPY
OH-0370	09/07/2017	06/19/2019	17.110	Emergency Generator	Diesel	State-of-the-art combustion design	NOx – 16.07 Lb/Hr & 4.02 TPY CO – 8.8 Lb/Hr & 2.2 TPY CO2e – 445 TPY VOC – 2 Lb/Hr & 0.5 TPY SO2 – 0.016 Lb/Hr & 4 x10-3 TPY TPM10 – 0.5 Lb/Hr & 0.13 TPY TPM2.5 – 0.5 Lb/Hr & 0.13 TPY
OH-0372	09/27/2017	06/19/2019	17.110	Emergency Generator	Diesel	ULSD State-of-the-art combustion design Good operating practices (proper maintenance and operation)	NOx – 16.1 Lb/Hr & 4.02 TPY CO – 8.8 Lb/Hr & 2.2 TPY CO2e – 445 TPY VOC – 2 Lb/Hr & 0.5 TPY SO2 – 0.016 Lb/Hr & 4 x10-3 TPY TPM10 – 0.5 Lb/Hr & 0.13 TPY TPM2.5 – 0.5 Lb/Hr & 0.13 TPY

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OH-0374	10/12/2017	06/19/2019	17.110	Emergency Generator	Diesel	Certified to the meet the emissions standards in 40 CFR 89.112 and 89.113 pursuant to 40 CFR 60.4205(b) and 60.4202(a)(2). Good combustion practices per the manufacturer's operating manual.	NOx – 23.21 Lb/Hr & 1.16 TPY CO – 12.69 Lb/Hr & 0.63 TPY CO2e – 120 TPY VOC – 23.21 Lb/Hr & 1.16 TPY SO2 – 0.0015 Lb/MMBtu & 0.022 Lb/Hr TPM - 0.73 Lb/Hr & 0.037 TPY TPM10 – 0.73 Lb/Hr & 0.037 TPY TPM2.5 – 0.73 Lb/Hr & 0.037 TPY
OH-0375	11/07/2017	06/19/2019	17.110	Emergency Generator	Diesel	ULSD Good combustion design	NOx – 24.71 Lb/Hr & 1.24 TPY CO – 12.64 Lb/Hr & 0.63 TPY CO2e – 116.8 TPY & None Listed VOC – 24.71 Lb/Hr & 1.24 TPY SO2 – 0.016 Lb/Hr & 4 x10-3 TPY TPM - 0.73 Lb/Hr & 0.037 TPY TPM10 – 0.73 Lb/Hr & 0.037 TPY TPM2.5 – 0.73 Lb/Hr & 0.037 TPY
OH-0376	02/09/2018	06/19/2019	17.110	Emergency Generator	Diesel	Comply with NSPS 40 CFR 60 Subpart IIII	NOx – 28.2 Lb/Hr & 7.05 TPY CO – 15.4 Lb/Hr & 3.86 TPY CO2e – 163.6 Lb/MMBtu & 683 TPY TPM10 – 1.01 Lb/Hr & 0.25 TPY TPM2.5 – 1.01 Lb/Hr & 0.25 TPY
OH-0377	04/19/2018	06/19/2019	17.110	Emergency Generator	Diesel	Good combustion practices (ULSD) Compliance with 40 CFR Part 60, Subpart IIII	NOx – 19.68 Lb/Hr & 0.98 TPY CO2e – 109.2 TPY VOC – 19.68 Lb/Hr & 0.98 TPY SO2 – 0.0015 Lb/Hr & 0.0023 Lb/Hr TPM - 0.62 Lb/Hr & 0.031 TPY TPM10 – 0.62 Lb/Hr & 0.031 TPY TPM2.5 – 0.62 Lb/Hr & 0.031 TPY

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OH-0378	12/21/2018	06/19/2019	17.110	Emergency Generator	Diesel	Certified to the meet the emissions standards in Table 4 of 40 CFR Part 60, Subpart IIII Shall employ good combustion practices per the manufacturer's operating manual	NOx – 37.41 Lb/Hr & 1.87 TPY CO – 19.25 Lb/Hr & 0.96 TPY CO2e – 200 TPY VOC – 37.41 Lb/Hr & 1.87 TPY TPM - 1.1 Lb/Hr & 0.055 TPY TPM10 – 1.1 Lb/Hr & 0.055 TPY TPM2.5 – 1.1 Lb/Hr & 0.055 TPY
OH-0378	12/21/2018	06/19/2019	17.110	Emergency Generator	Diesel	Certified to the meet the emissions standards in Table 4 of 40 CFR Part 60, Subpart IIII Shall employ good combustion practices per the manufacturer's operating manual	NOx – 14.96 Lb/Hr & 0.75 TPY CO – 7.7 Lb/Hr & 0.39 TPY CO2e – 80 TPY VOC – 14.96 Lb/Hr & 0.75 TPY TPM - 0.44 Lb/Hr & 0.022 TPY TPM10 – 0.44 Lb/Hr & 0.022 TPY TPM2.5 – 0.44 Lb/Hr & 0.022 TPY
PA-0291	04/23/2013	03/02/2020	17.110	Emergency Generator	Diesel	ULSD	NOx – 9.89 Lb/Hr & 0.49 TPY CO – 5.79 Lb/Hr & 0.29 TPY CO2e – 80.5 TPY SOx – 0.01 Lb/Hr & 0.0007 TPY VOC – 0.7 Lb/Hr & 0.03 12-Month Rolling TOT HS – 0.0028 Lb/Hr 7 0.0001 TPY TPM – 0.02 TPY & None Listed
SC-0193	04/15/2016	09/10/2021	17.110	Emergency Generators and Fire Pump	#2 Fuel Oil	Meet emission standards of 40 CFR 60, Subpart IIII	VOC – 100 Hrs/Yr TPM - 100 Hrs/Yr TPM10 – 1100 Hrs/Yr TPM2.5 – 100 Hrs/Yr

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
TX-0671	12/01/2014	03/06/2019	17.110	Engines	Diesel	ULSD Each emergency generator's emission factor is based on USEPA's Tier 2 standards at 40CFR89.112 for NOx	NOx – 5.43 G/kW-Hr & 2.39 TPY SO2 – 0.0649 G/kW-Hr & 0.01 TPY
TX-0728	04/01/2015	01/21/2020	17.110	Emergency Generator	Diesel	Minimized hours of operations Tier II engine	NOx – 0.0218 G/Hp-Hr & 0.35 TPY CO – 0.0126 G/Hp-Hr & 0.2 TPY SO2 – 0.61 Lb/Hr 7 0.02 TPY VOC – 0.7 Lb/Hr & 0.02 TPY TPM - 0.15 Lb/Hr & 0.01 TPY TPM10 – 0.15 Lb/Hr & 0.01 TPY TPM2.5 – 0.15 Lb/Hr & 0.01 TPY
TX-0872	10/31/2019	11/12/2020	17.110	Emergency Generator	Diesel	ULSD Limiting duration and frequency of generator use to 100 hr/yr Good combustion practices would be used to reduce VOC including maintaining proper air-to-fuel ratio.	VOC – 0.12 G/kW-Hr CO – 0.6 G/kW-Hr
TX-0876	02/06/2020	11/12020	17.110	Emergency Generator	Diesel	Tier 4 exhaust emission standards specified in 40 CFR Part 1039.101 Limited to 100 hours per year of non-emergency operation	SO2 – 15 PPMW
TX-0904	09/09/2020	12/01/2021	17.110	Emergency Generator	Diesel	ULSD 100 hours of operation Tier 4 exhaust emission standards specified in 40 CFR Part 1039.101	None Listed

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TX-0905	09/16/2020	09/10/2021	17.110	Emergency Generator	Diesel	ULSD Limited to 100 hours per year of non- emergency operation	None Listed
TX-0911	12/15/2020	05/10/2021	17.110	Emergency Generator	Diesel	ULSD	None Listed
TX-0955	03/14/2023	03/14/2023	17.110	Emergency Generator	Diesel	ULSD	NOx – 3.9 G/Hp-Hr
VA-0321	03/12/2013	06/19/2019	17.110	Emergency Generator	Diesel	ULSD Good combustion practices	CO - 3.5 G/kW & 4.3 TPY
VA-0325	06/17/2016	06/19/2019	17.110	Emergency Generator	Diesel	Good Combustion Practices/Maintenance	CO2e - 163.6 Lb/MMBtu & 1178 TPY CO2 – 3.5 G/kW & 5.8 TPY NOx - 6.4 G/kW & 10.6 TPY TPM10 – 0.4 G/kW & 1 TPY TPM2.5 – 0.4 G/KR & 0.7 TPY SO2 – 0.0015 Lb/MMBtu SA – 0.0001 Lb/MMBtu VOC – 6.4 G/kW
VA-0328	04/26/2018	06/19/2019	17.110	Emergency Generator	Diesel	ULSD Good combustion practices	CO2e – 981 TPY CO2 – 2.6 G/Hp-Hr & 5.2 TPY NOx - 4.8 G/Hp-hr & 9.6 TPY TPM10 – 0.15 G/Hp-Hr TPM2.5 – 0.15 G/Hp-Hr
VA-0332	06/24/2018	05/19/2021	17.110	Emergency Generator	Diesel	ULSD Good combustion practices High efficiency design	CO2e – 12.3 TPY CO2 – 2.6 G/Hp-Hr & 6.4 TPY NOx – 4.8 G/Hp-Hr & 11.7 TPY FPM – 0.15 G/Hp-Hr TPM10 – 0.15 G/Hp-Hr TPM2.5 – 0.15 G/Hp-Hr SO2 – 0.0015 Lb/MMBtu

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AR-0084	06/30/2017	04/16/2020	17.110	Black Start and Emergency Internal Combustion Engines	Diesel	Clean Fuel Good Combustion Practices	NOx – 8 G/kW-Hr CO – 4.38 G/kW-Hr TPM – 0.25 G/kW-Hr TPM10 – 0.25 G/kW-Hr TPM2.5 – 0.25 G/kW-Hr CO2e – 2781 TPY
AR-0084	06/30/2017	04/16/2020	17.110	Twelve (12) Large ULSD/ Natural Gas-Fired Internal Combustion Engines	Diesel and Natural Gas	Oxidation Catalyst Good Combustion Practices Clean Fuel	VOC – 0.21 G/kW-Hr & 0.09 G/kW-Hr TPM – 0.29 G/kW-Hr & 0.13 G/kW-Hr FPM – 0.15 G/kW-Hr TPM10 – 0.29 G/kW-Hr & 0.13G/kW-Hr FPM10 – 0.15 G/kW-Hr TPM2.5 – 0.29 G/kW-Hr & 0.13 G/kW-Hr FPM2.5 – 0.15 G/kW-Hr NOx – 0.53 G/kW-Hr & 0.08 G/kW-Hr CO – 0.18 G/kW-Hr & 0.12 G/kW-Hr CO2e – 1299630 TPY (ULSD) & 869621 TPY
AK-0085	08/13/2020	03/31/2021	17.110	One (1) Black Start Generator Engine	ULSD	Good combustion practices Limit operation to 500 hours per year	NOx – 3.3 G/kW-Hr CO – 3.3 G/kW-Hr TPM – 0.045 G/kW-Hr TPM10 – 0.045 G/kW-Hr TPM2.5 – 0.045 G/kW-Hr SO2 – 15 G/kW-Hr VOC – 0.18 G/kW-Hr CO2e – 163.6 Lb/MMBtu

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
FL-0363	12/04/2017	11/22/2021	17.110	Two 3300 kW emergency generators	ULSD	Certified engine Clean Fuel	CO – 3.5 G/kW-Hr FPM – 0.2 G/kW-Hr SO2 – 15 PPM Sulfur fuel
FL-0367	07/27/2018	11/22/2021	17.110	1,500 kW Emergency Diesel Generator	ULSD	Operate and maintain the engine according to the manufacturer's written instructions	NOx – 6.4 G/kW-Hr CO – 3.5 G/kW-Hr FPM – 0.2 G/kW-Hr SO2 – 15 PPM Sulfur fuel
FL-0371	06/07/2021	11/22/2021	17.110	1,500 kW Emergency Diesel Generator	ULSD	None Listed	CO – 3.5 G/kW-Hr TPM – 0.2 G/kW-Hr NOx 6.4 - G/kW-Hr SO2 – 15 PPM Sulfur fuel
IL-0130	12/31/2018	04/16/2020	17.110	Emergency Engine	ULSD	None Listed	NOx – 6.4 G/kW-Hr CO – 3.5 G/kW-Hr TPM – 0.2 G/kW-Hr CO2e – 225 TPY
KY-0110	07/23/2020	01/25/2021	17.110	EP 10-02 - North Water System Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 4.77 G/kW-Hr
KY-0110	07/23/2020	01/25/2021	17.110	EP 10-03 - South Water System Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 4.77 G/kW-Hr
KY-0110	07/23/2020	01/25/2021	17.110	EP 10-04 - Emergency Fire Water Pump	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr
							NOx – 4.77 G/kW-Hr

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
KY-0110	07/23/2020	01/25/2021	17.110	EP 11-01 - Melt Shop Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 4.77 G/kW-Hr
KY-0110	07/23/2020	01/25/2021	17.110	EP 11-02 - Reheat Furnace Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 4.77 G/kW-Hr
KY-0110	07/23/2020	01/25/2021	17.110	EP 10-07 - Air Separation Plant Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 4.77 G/kW-Hr
KY-0110	07/23/2020	01/25/2021	17.110	EP 10-01 - Caster Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 4.77 G/kW-Hr
KY-0115	04/19/2021	05/26/2021	17.110	New Pumphouse (XB13) Emergency Generator #1 (EP 08-05)	Diesel	The permittee must develop a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr
KY-0115	04/19/2021	05/26/2021	17.110	Tunnel Furnace Emergency Generator (EP 08-06)	Diesel	The permittee must develop a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
KY-0115	04/19/2021	05/26/2021	17.110	Caster B Emergency Generator (EP 08-07)	Diesel	The permittee must develop a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr
KY-0115	04/19/2021	05/26/2021	17.110	Cold Mill Complex Emergency Generator (EP 09-05)	Diesel	The permittee must develop a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr

Table 4-2. Recent RBLC Database for Small (<500 HP) Engines.

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
MI-0453	09/27/2022	09/27/2022	17.210	Emergency Engine	ULSD	Exclusive use of ULSD Good combustion practices Limited hours of operation Designed to achieve emission limits	FPM – 0.15 G/Hp-Hr PM10 – 0.15 G/Hp-Hr PM2.5 – 0.15 G/Hp-Hr VOC – 0.19 G/Hp-Hr
OH-0837	09/20/2022	09/20/2022	17.210	Emergency Engine – Fire Water Pump	ULSD	Comply with NSPS 40 CFR 60 Subpart IIII	TPM – 0.2 G/kW-Hr TPM10 – 0.2 G/kW-Hr TPM2.5 – 0.2 G/kW-Hr CO – 3.5 G/kW-Hr NOx – 4.00 G/kW
IL-0133	07/29/2022	07/29/2022	17.210	Emergency Engine – Fire Water Pump	ULSD	Comply with NSPS 40 CFR 60 Subpart IIII	TPM – 0.2 G/kW-Hr TPM10 – 0.2 G/kW-Hr TPM2.5 – 0.2 G/kW-Hr CO – 3.5 G/kW-Hr NOx – 4.00 G/kW
MI-0451	06/23/2022	08/12/2020	17.210	Emergency Engine – Fire Water Pump	ULSD	Comply with NSPS 40 CFR 60 Subpart IIII	NOx – 3 G/Hp-Hr SO2 – 0.0049 G/Hp-Hr CO – 2.6 G/Hp-Hr FPM – 0.15 G/Hp-Hr PM10 – 0.15 G/Hp-Hr PM2.5 – 0.15 G/Hp-Hr
MI-0447	01/07/2021	9/10/2021	17.210	Emergency Engine	Diesel	ULSD Good combustion practices NSPS Compliant Catalytic oxidation was the control considered technically feasible. However, it was not considered economically feasible.	CO – 2.6 G/kW-Hr PM10 – 0.12 lb/hr PM2.5 – 0.12 lb/hr CO2e – 20 TPY

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
MD-0042	04/08/2014	08/12/2020	17.210	Emergency Engine – Fire Water Pump	ULSD	Exclusive use of ULSD Good combustion practices Limited hours of operation Designed to achieve emission limits	NOx – 3 G/Hp-Hr SO2 – 0.0049 G/Hp-Hr CO – 2.6 G/Hp-Hr FPM – 0.15 G/Hp-Hr PM10 – 0.15 G/Hp-Hr PM2.5 – 0.15 G/Hp-Hr
MI-0441	12/21/2018	08/09/2021	17.210	Emergency Engines	Diesel	Good combustion practices and energy efficiency measures	CO – 2.6 G/Hp-Hr CO2e – 20 TPY PM10 – 0.12 G/Hp-Hr PM2.5 – 0.12 G/Hp-Hr
OH-0376	02/09/2018	06/19/2019	17.210	Emergency Generator	Diesel	Comply with NSPS 40 CFR 60 Subpart IIII	NOx – 1.6 Lb/Hr & 0.41 TPY CO – 1.4 Lb/Hr & 0.36 TPY CO2e – 163.6 Lb/MMBtu & 79 TPY TPM10 – 0.1 Lb/Hr & 0.02 TPY TPM2.5 – 0.1 Lb/Hr & 0.02 TPY
OH-0379	02/06/2019	06/19/2019	17.210	Black Start Generator	Diesel	Tier IV NSPS standards certified by engine manufacturer	NOx – 0.104 Lb/Hr & 5.2 x10-3 TPY CO2e – 181.7 TPY & 9.09 TPY TPM10 – 5.2 x10-3 Lb/Hr & 2.61 x10-4 TPY TPM2.5 – 5.2 x10-3 Lb/Hr & 2.61 x10-4 TPY

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
OH-0379	02/06/2019	06/19/2019	17.210	Emergency Generator	Diesel	Tier IV engine Good combustion practices	NOx – 3.45 Lb/Hr & 0.17 TPY CO2e – 3632 TPY & 181.6 TPY TPM10 – 0.15 Lb/Hr & 0.01 TPY TPM2.5 – 0.15 Lb/Hr & 0.01 TPY
AR-0168	03/17/2021	05/26/2021	17.210	Emergency Engines	Diesel	Good Operating Practices Limited hours of operation Compliance with NSPS Subpart IIII	TPM – 0.2 G/kW-Hr TPM10 – 0.2 G/kW-Hr TPM2.5 – 0.2 G/kW-Hr VOC – 1.55 G/kW-Hr SO2 – 0.0015 % Sulfur CO – 3.5 G/kW-Hr NOx – 4.86 G/kW-Hr CO2 – 163 Lb/MMBtu CH4 – 0.0061 Lb/MMBtu N2O – 0.0013 Lb/MMBtu
AR-0171	02/14/2019	09/10/2021	17.210	SN-106 Cold Mill 1 Diesel Fired Emergency Generator	Diesel	Good operating practices	TPM – 0.25 G/kW-Hr TPM10 – 0.2 G/kW-Hr TPM2.5 – 02 G/kW-Hr NOx – 2 G/kW-Hr CO – 4 G/kW-Hr CO2e – 163 Lb/MMBtu SO2 – 0.0006 Lb/MMBtu
KY-0110	07/23/2020	01/25/2021	17.210	EP 11-03 - Rolling Mill Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 2.98 G/kW-Hr

Determination Number	Permit Date	Date Determination Last Updated	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information
KY-0110	07/23/2020	01/25/2021	17.210	EP 11-04 - IT Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.15 G/kW-Hr TPM10 – 0.15 G/kW-Hr TPM2.5 – 0.15 G/kW-Hr CO – 2.61 G/kW-Hr NOx – 2.98 G/kW-Hr
KY-0110	07/23/2020	01/25/2021	17.210	EP 11-05 - Radio Tower Emergency Generator	Diesel	This EP is required to have a Good Combustion and Operating Practices (GCOP) Plan.	FPM – 0.3 G/kW-Hr TPM10 – 0.3 G/kW-Hr TPM2.5 – 0.3 G/kW-Hr CO – 3.73 G/kW-Hr NOx – 3.5 G/kW-Hr
LA-0345	06/13/2018	08/092021	17.210	IC engines (14 units)	Diesel	Comply with requirements of 40 CFR 60 Subpart IIII	None Listed
LA-0349	07/10/2018	08/06/2021	17.210	IC Engines (18)	Diesel	Comply with 40 CFR 60 Subpart IIII Good Combustion Practices	None Listed
LA-0379	05/04/2021	12/07/2021	17.210	PVC Emergency Combustion Equipment A	Diesel	Good combustion practices/gaseous fuel burning	TPM – 0.4 G/Hp-Hr TPM10 – 0.4 G/Hp-Hr NOx – 6.9 G/Hp-Hr CO – 8.5 G/Hp-Hr
LA-0379	05/04/2021	12/07/2021	17.210	PVC Emergency Combustion Equipment 2A and 2B	Diesel	Compliance with 40 CFR 60 Subpart IIII.	TPM – 0.4 G/Hp-Hr TPM10 – 0.4 G/Hp-Hr NOx – 0.4 G/kW-Hr CO – 2.6 G/Hp-Hr VOC – 0.19 G/kW-Hr
LA-0381	12/16/2021	12/16/2021	17.210	Emergency Engines 2-19 and 3-19 (EQT0904 and EQT0905)	Diesel	Comply with standards of 40 CFR 60 Subpart IIII	Not Listed

Table 4-3. RLBC Database (OCS Air Permit Determinations)

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Description	Extended Facility Description
12/31/2014	OCS-EPA-R4019	7/7/2016	FL-0350	Anadarko Petroleum, Inc. Diamond Blackhawk Drilling Project	17.110	Main Propulsion Generator Engines (6035 HP)	Diesel	Use of good combustion practices based on the most recent manufacturer's specifications issued for these engines at the time that the engines are operating under this permit	NOx: DR-ME-01 through DR-ME-08 Operating at 50% Load and Above: 10.57 g/kWh on a rolling 24-hour average basis. DR-ME-01 through DR-ME-06 Operating Below 50% Load: 57.3 lb/hr on a rolling 24-hour average basis. DR-MR-07 and DR-ME-08 Operating Below 50% Load: 103.5 lb/hr on a rolling 24-hour average basis. PM: Not Listed	Six 2012 Hyundai- HiMsen 9H32/40V 6,035 HP and two 2012 Hyundai-HiMsen 18H32/40V diesel electric engines	The facility consists of the BlackHawk drillship owned by Diamond Offshore Drilling Inc., and associated support vessels. The support vessels may include a combination of supply boats, anchor handling boats, tug boats, barges, stimulation vessels and well evaluation vessels. The proposed project will consist of three phases: the drilling phase, the well completion phase, and the production well maintenance phase. Anadarko will conduct drilling activities at multiple locations in the OCS in the Eastern Gulf of Mexico.
9/16/2014	OCS-EPA-R4015	7/6/2016	FL-0347	Anadarko Petroleum, Inc. - EGOM	17.110	Main Propulsion Generator Engines (9910 HP)	Diesel	Use of good combustion practices based on the most recent manufacturer's specifications issued for engines and with turbocharger, aftercooler, and high injection pressure	NOx: 12.7000 g/kWh Rolling 24-Hour Average PM_{10}: 0.24 g/kWh Rolling 24-Hour Average PM: 0.43 g/kWh Rolling 24-Hour Average $PM_{2.5}$: 0.24 g/kWh Rolling 24-Hour Average	Four 1998 Wartsila 18V32LNE 9910 HP and Two 1998 Wartsila 12V32LNE 6610 HP	The facility consists of a mobile offshore drilling unit using the Transocean Discoverer Spirit and associated support vessels. The drilling sites are located east of longitude 87.5, west of the Military Mission Line (86°41' west longitude), at least 100 miles from the Louisiana shoreline, and at least 125 miles from the Florida shoreline.
					17.110	Emergency Engine (3300 HP)	Diesel	Use of good combustion practices based on the most recent manufacturer's specifications issued for engines and with turbocharger, aftercooler, and high injection pressure	Not Listed	1998 Wartsila 6R32LNE	
					17.210	Remotely Operated Vehicle Emergency Generator (427 HP)	Diesel	Use of good combustion practices based on the most recent manufacturer's specifications issued for engines and with turbocharger, aftercooler, and high injection pressure	Not Listed	2004 Cummins QSM11-G2NR3	
5/30/2012	OCS-EPA-R4008	5/4/2016	FL-0338	Sake Prospect Drilling Project	17.110	Main Propulsion Engines - C.R. Luigs (5875 HP)	Diesel	Use of good combustion practices based on the current manufacturer's specifications for these engines, and additional enhanced work practice standards including an engine performance management system, positive crankcase ventilation, turbocharger with aftercooler, and high-pressure fuel injection with aftercooler.	NOx: 18.1000 g/kWh 24-Hour Rolling FPM_{10}: 0.24 g/kWh Rolling 24-Hour Average FPM: 0.43 g/kWh Rolling 24-Hour Average $FPM_{2.5}$: 0.24 g/kWh Rolling 24-Hour Average	C.R. Luigs has 8 identical MAN B&W 9L32/40-47 5,875 HP diesel electric engines	The facility consists of a mobile offshore drilling unit using either the Transocean ultra-deepwater C.R. Luigs or the Transocean semisubmersible DD1 to conduct exploratory oil and natural gas drilling in lease blocks within the DeSoto Canyon area of the Gulf of Mexico.
					17.110	Main Propulsion Engines - Development Driller 1 (5096 HP)	Diesel	Use of good combustion practices based on the current manufacturer's specifications for these engines, and additional enhanced work practice standards including an engine performance management system, positive crankcase ventilation, turbocharger with aftercooler, and high-pressure fuel injection with aftercooler.	NOx: 12.1000 g/kWh 24-Hour Rolling FPM: 0.43 g/kWh Rolling 24-Hour Average FPM_{10}: 0.43 g/kWh Rolling 24-Hour Average $FPM_{2.5}$: 0.57 g/kWh Rolling 24-Hour Average	Development Driller 1 has eight identical 2002 Caterpillar Model 3612-DITA, 5096 HP diesel electric engines.	
					17.210	Port and Stb Fwd and Aft Crane Diesel Engines - C.R. Luigs (305 HP)	Diesel	Use of good combustion practices based on the current manufacturer's specifications for these engines, use of low sulfur diesel fuel, positive crankcase ventilation, turbocharger with aftercooler, high pressure fuel injection with aftercooler	NOx: 82.8300 tons per 12-month rolling total PM: 5.88 g/kWh Rolling 24-Hour Average PM_{10}: 5.88 g/kWh Rolling 24 Hour Average $PM_{2.5}$: 5.88 g/kWh Rolling 24 Hour Average		

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Description	Extended Facility Description
5/15/2012	OCS-EPA-R4009	7/7/2016	FL-0348	Murphy Exploration & Production Co.	17.210	Main Propulsion Generators (4425 HP)	Diesel	Use of engine with turbo charger with after cooler, an enhanced work practice power management, NOx emissions maintenance system, and good combustion and maintenance practices based on the current manufacturer's specifications for each engine.	NOx: 26.0000 g/kWh Rolling 24-Hour Average PM: 9.9 tons per 12-month rolling total	Eight 1986 Wärtsilä F316A Diesel Engines	The facility consists of the dynamically positioned Diamond Offshore deepwater drilling vessel Ocean Confidence and an associated support fleet to conduct exploratory drilling and well completion for up to 90 calendar days within a 2-year period at a single well location within its Lloyd Ridge lease block 317. The drill site is located on the OCS in the Gulf of Mexico, approximately 135 miles southeast of the mouth of the Mississippi River and 180 miles from the Florida shoreline.
10/27/2011	OCS-EPA-R4007	4/14/2016	FL-0328	ENI - Holy Cross Drilling Project	17.110	Main Propulsion Engines (>500 HP)	Diesel	Use of good combustion practices based on the current manufacturer's specifications for these engines, and additional enhanced work practice standards including an engine performance management system and the Diesel Engines with Turbochargers (DEWT) measurement system.	NOx: 12.7000 g/kWh 24-Hour Rolling FPM: 0.43 g/kWh Rolling 24-Hour Average PM_{10}: 0.24 g/kWh Rolling 24-Hour Average $PM_{2.5}$: 0.24 g/kWh Rolling 24-Hour Average	Wärtsilä Vasa 18V32 LNE and Wärtsilä Vasa 12V32 LNE model engines	The project, known as the Holy Cross Drilling Project, would mobilize the Pathfinder drillship, and support vessels to drill in the Gulf of Mexico, Lloyd Ridge lease block 411, to determine the presence of natural gas. The exploratory drilling activity would consist of two phases: the initial drilling phase and the well completion phase; the Pathfinder would complete both phases. The operation would last up to two years, and based on applicable permitting regulations, is a "temporary source" for PSD permitting purposes.
					17.110	Crane Engines (units 1 and 2) (>500 HP)	Diesel	Use of certified USEPA Tier 1 engines and good combustion practices based on the current manufacturer's specifications for this engine	NOx: 9.5000 Tons per Year 12-Month Rolling PM: 0.6 tons per 12-month rolling total PM_{10}: 0.6 tons per 12-month rolling total $PM_{2.5}$: 0.6 tons per 12-month rolling total	Caterpillar 3408 - 1997 model year engines	
					17.110	Crane Engines (units 3 and 4) (>500 HP)	Diesel	Use of good combustion practices, based on the current manufacturer's specifications for this engine	NOx: 9.7000 Tons per Year 12-Month Rolling PM: 1.3 tons per 12-month rolling total PM_{10}: 0.6 tons per 12-month rolling total $PM_{2.5}$: 0.6 tons per 12-month rolling total	Caterpillar 3406 - 2008 model year engines	
6/13/2011	OCS-EPA-R4005	10/11/2012	FL-0327	Anadarko Phoenix Prospect	17.110	Main Propulsion Engines (>500 HP)	Diesel	Use of good combustion and maintenance practices, Power Management System, and NOx Concentration Maintenance System as described in the OCS permit application.	NOx: 12.7000 g/kWh 24-Hour Rolling PM: Not Listed	Wartsila 18V32 LNE and Wartsila 12V32 LNE model engines	The proposed project, known as the Phoenix Prospect, will mobilize the Discoverer Spirit, a work boat, a crew boat, and an anchor handling boat to drill a single exploration well on the OCS in Lloyd Ridge Lease Block 410 to determine if natural gas reserves are present in this location. The well's objective depth is 16,100 feet true vertical depth sub-sea or 6,300 feet below the mud line of the seafloor and will be drilled in approximately 9,800 feet of water from the dynamically positioned Discoverer Spirit. The operation is expected to last less than 92 days, and based on applicable permitting regulations, is a "temporary source" for permitting purposes.

Table 4-4. RLBC Database (Large Diesel Internal Combustion Engines (> 500 HP))

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
3/22/2018	122-17	2/19/2019	MI-0434	Flat Rock Assembly Plant	17.21	Emergency Engine (670 HP)	Diesel	Use of good combustion practices	NOx: 2.99 g/HP-hr PM: Not Listed	One (1) diesel-fueled emergency engine/generator rated at 500 kW.	The existing FRAP is an automotive manufacturing plant which consists of a stamping operation, a body shop, a paint shop, and a final assembly shop. The permit application is for the proposed installation of an electronic data center with backup emergency generators at FRAP.
9/21/2018	PDS-LA-805	2/19/2019	LA-0331	Calcasieu Pass LNG Project	17.11	Emergency Engines (5364 HP)	Diesel	Compliance with NSPS IIII, good combustion, limit normal operation to 100 hr/yr, and operating practices	NOx: 4.18 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Large Emergency Engines (50 kW)	New LNG production, storage, and export terminal.
7/30/2018	16060032	2/19/2019	IL-0129	CPV Three Rivers Energy Center	17.11	Emergency Engine (2010 HP)	ULSD	Compliance with NSPS IIII	NOx: Not Listed PM: Not Listed	Other units include an auxiliary boiler, fuel heater, engines, natural gas piping and components, circuit breakers and roadways.	The proposed facility is designed to generate baseload power. It will consist of two combined-cycle generating units, each with a CT and associated HRSG. The turbines would burn natural gas and ULSD as a backup fuel. Other units include an auxiliary boiler, fuel heater, engines, natural gas piping and components, circuit breakers and roadways.
7/27/2018	1010524-001-AC	3/19/2019	FL-0367	Shady Hills Combined Cycle Facility	17.11	Emergency Engine (2010 HP)	ULSD	Operate and maintain the engine according to the manufacturer's written instructions	NOx: 4.78 g/HP-hr FPM: 0.15 g/HP-hr	1,500 kW Emergency Diesel Generator	A 573 MW (winter) 1-on-1 combined cycle plant which includes a HRSG with duct firing, along with supporting equipment. Natural gas is the only permitted fuel for the combined cycle unit.
7/16/2018	19-18	2/19/2019	MI-0435	Belle River Combined Cycle Power Plant	17.11	Emergency Engine (2682 HP)	Diesel	Use of good combustion practices	NOx: 4.78 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 1.18 lb/h $PM_{2.5}$: 1.18 lb/h	EU EMENGINE: Emergency engine	Natural gas combined-cycle power plant
6/29/2018	167-17 and 168-17	2/19/2019	MI-0433	MEC North, LLC And MEC South LLC	17.11	Emergency Engine (1341 HP)	Diesel	Use of certified USEPA engine per NSPS IIII and good combustion practices	NOx: 4.78 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.54 lb/h $PM_{2.5}$: 0.52 lb/h	EU EMENGINE (north plant): emergency engine	Natural gas combined cycle power plant (two plants: north and south)
					17.11	Emergency Engines (1341 HP)	Diesel	Use of certified USEPA engine per NSPS IIII and good combustion practices	NOx: 4.78 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.54 lb/h $PM_{2.5}$: 0.52 lb/h	EU EMENGINE (south plant): emergency engine	
4/26/2018	52588	3/18/2019	VA-0328	C4GT, LLC	17.11	Emergency Engine	ULSD	Use of good combustion practices and the use of ULSD fuel oil with a maximum sulfur content of 15 parts per million weight.	NOx: 4.8 g/HP-hr FPM: 0.15 g/hp-hr PM_{10}: 0.15 g/hp-hr $PM_{2.5}$: 0.15 g/hp-hr	Emergency diesel gen	Natural gas-fired combined cycle power plant
3/22/2018	122-17	2/19/2019	MI-0434	Flat Rock Assembly Plant	17.11	Emergency Engines (3633 HP)	Diesel	Use of good combustion practices	NOx : 4.78 g/HP-hr PM: Not Listed	EUENGINE01 through EUENGINE08	The existing FRAP is an automotive manufacturing plant which consists of a stamping operation, a body shop, a paint shop, and a final assembly shop. The permit application is for the proposed installation of an electronic data center with backup emergency generators at FRAP.
12/18/2017	309-0075	1/11/2018	AL-0318	Talladega Sawmill	17.11	Emergency Engine (250 HP)	Diesel	None Listed	NOx: Not Listed PM: Not Listed	250 HP Emergency CI, Diesel-fired RICE	A sawmill that produces kiln dried dimensional lumber.

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
9/15/2017	R14-0015M	5/1/2018	WV-0027	Inwood	17.11	Emergency Engine (900 HP)	ULSD	Engine Design	NOx: 4.77 g/HP-hr PM_{10}:: 0.2 g/HP-hr	Emergency generator - esdg14	Insulation manufacturing facility
6/30/2017	PSD-LA-780(M-1)	2/13/2019	LA-0312	St. James Methanol Plant	17.11	Emergency Engine (1474 HP)	Diesel	Compliance with NSPS IIII	NOx: 19.23 lb/hr PM_{10}:: 0.08 lb/hr $PM_{2.5}$: 0.08 lb/hr	DEG1-13 - diesel fired emergency generator engine (EQT0012)	New Methanol plant designed to produce 5,275 metric tons per day of refined methanol from natural gas and CO_2 feedstock
6/30/2017	AQ0934CPT01	6/22/2018	AK-0084	Donlin Gold Project	17.11	Emergency Engines (2010 HP)	Diesel	Use of good combustion practices and NSPS Subpart IIII engines.	NOx: 5.97 g/HP-hr PM: 0.19 g/HP-hr PM_{10}:: 0.19 lb/hr $PM_{2.5}$: 0.19 lb/hr	Black Start and Emergency ICEs	The Donlin Gold Project is a gold mine located 12 miles north of Crooked Creek, Alaska on the Kuskokwim River, about 280 miles northwest of Anchorage. The deposit has proven and probable reserves estimated at 33.9 million ounces of gold at 2.1 grams per ton and could produce up to 1.5 million ounces annually.
					17.11	Dual Fuel ICEs (22797 HP)	Diesel and Natural Gas	SCR and good combustion practices	NOx 0.4 g/HP-hr PM: 0.22 g/HP-hr FPM: 0.11 lb/hr PM_{10}:: 0.22 lb/hr $PM_{2.5}$: 0.22 lb/hr	12 large ULSD/natural gas-fired ICEs	
6/21/2017	NE-15-018	11/27/2017	MA-0043	MIT Central Utility Plant	17.11	Cold Start Engine	ULSD	None listed	NOx: 35.09 lb/hr PM_{10}: 0.4 lb/hr $PM_{2.5}$: 0.4 lb/hr	Cold start engine	MIT proposes to construct and operate two new 22- MW combined heat and power CTs/HRSGs and a new cold start engine at its existing central utility plant.
5/9/2017	59-16A	11/15/2017	MI-0425	Grayling Particleboard	17.11	Emergency Engine (2010 HP)	Diesel	EPA certified engines and limited operating hours.	NOx: 21.2 lb/hr FPM: 0.66 lb/hr PM_{10}: 0.66 lb/hr $PM_{2.5}$: 0.66 lb/hr	EUEMRGRICE1 in FGRICE (Emergency diesel generator engine)	Particleboard manufacturing.
					17.11	Emergency Engine (2010 HP)	Diesel	EPA certified engines and limited operating hours.	NOx: 4.4 lb/hr FPM: 0.18 lb/hr PM_{10}: 0.18 lb/hr $PM_{2.5}$: 0.18 lb/hr	EUEMRGRICE2 in FGRICE (Emergency Diesel Generator Engine)	
3/23/2017	129-36943-00059	8/22/2017	IN-0263	Midwest Fertilizer Company LLC	17.11	Emergency Engines (3600 HP)	Diesel	Use of good combustion practices	NOx: 4.42 g/HP-hr PM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency generators (eu014a and eu-014b)	Stationary nitrogen fertilizer manufacturing facility
2/17/2017	PSD-LA-766(M3)	4/28/2017	LA-0316	Cameron LNG Facility	17.11	Emergency Engines (3353 HP)	Diesel	Compliance with NSPS IIII	Not Listed	Emergency generator engines (6 units)	Facility to liquefy natural gas for export (5 trains)
1/4/2017	75-16	3/8/2018	MI-0423	Indeck Niles, LLC	17.11	Emergency Engine (2992 HP)	Diesel	Use of certified USEPA engine per NSPS IIII and good combustion practices	NOx: 4.78 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 1.58 lb/hr $PM_{2.5}$: 1.58 lb/hr	EUEMENGINE (Diesel fuel emergency engine)	Natural gas combined cycle power plant.
12/22/2016	PSD-LA-761(M4)	4/28/2017	LA-0317	Methanex - Geismar Methanol Plant	17.11	Emergency Engines (2 @ 2346 HP, 1 @ 755 HP, 1 @ 1193 HP)	Diesel	Compliance with NSPS IIII and 40 CFR 63 Subpart ZZZZ	Not Listed	Emergency Generator Engines (4 units)	Methanol plant (Unit I and Unit II) to produce 6,000 metric tons of methanol by steam reforming natural gas

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9/2/2016	11-00536A	12/21/2018	PA-0310	CPV Fairview Energy Center	17.11	Emergency Engines (2010 HP)	ULSD	None Listed	NOx: 4.8 g/HP-hr PM: 0.15 g/HP-hr	Two (2) 1,500-ekW diesel-fired emergency genset engines. One (1) 422 BHP diesel-fired fire water pump engine.	This plan approval authorizes CPV Fairview, LLC to construct and temporarily operate the Fairview Energy Center. Air contamination sources and air cleaning devices authorized for construction and temporary operation under this plan approval include: A combined cycle electric generating unit consisting of two GE CTs each with maximum fuel type-based heat input of 3,338-MMBtu/hr (natural gas), 3,274-MMBtu/hr (ULSD), 3,199 MMBtu/hr (ethane blend), and equipped with dry low-NOx combustors and evaporative turbine intake cooling; two HRSGs each equipped with a low-NOx duct burner with maximum heat input of 425-MMBtu/hr, and a common STG. Exhaust emissions from each combined cycle electric generating unit will be controlled by oxidation catalyst and SCR.
8/31/2016	PSD-LA-804	4/28/2017	LA-0313	St. Charles Power Station	17.11	Emergency Engine (2584 HP)	Diesel	Good combustion practices, compliance with NESHAP 40 CFR 63 Subpart ZZZZ and NSPS 40 CFR 60 Subpart IIII and use of ULSD	NOx: 27.34 lb/hr FPM: 0.86 lb/hr $FPM_{2.5}$: 0.86 lb/hr	St. Charles Power Station emergency diesel generator 1	The St. Charles Power Station is a new electric power generating facility consisting of two natural gas-fired combined cycle gas turbines, each with a HRSG unit equipped with duct burners, and one steam generator turbine. The St. Charles Power Station will have a predicted net nominal output of 980 MW at iso conditions with supplemental duct firing.
8/26/2016	59-16	7/20/2017	MI-0421	Grayling Particleboard	17.11	Emergency Engine (2144 HP)	Diesel	EPA certified engines and limited operating hours	NOx: 22.6 lb/hr FPM: 1.41 lb/hr PM_{10}: 1.41 lb/hr $PM_{2.5}$: 1.41 lb/hr	Emergency diesel generator engine (EUEMRGRICE in FGRICE)	Particleboard manufacturing
6/30/2016	PSD-LA-803(M1)	4/28/2017	LA-0305	Lake Charles Methanol Facility	17.11	Emergency Engines (4023 HP)	Diesel	Compliance with NSPS IIII	Not Listed	Diesel engines (emergency)	Proposed facility to produce methanol, hydrogen, sulfuric acid, CO_2, argon, and electricity from pet coke.
6/17/2016	52525	2/24/2017	VA-0325	Greensville Power Station	17.11	Emergency Engine (4020 HP)	Diesel	Use of good combustion and maintenance practices and Ultra Low Sulfur Diesel/Fuel (15 ppm max)	NOx: 6.4 G/kW PM_{10}: 0.4 G/kW $PM_{2.5}$: 0.4 G/kW	Diesel-fired emergency generator 3000 kW (1)	The proposed project will be a new, nominal 1,600 MW combined-cycle electrical power generating facility utilizing three CTs each with a duct-fired HRSG with a common reheat condensing STG (3 on 1 configuration). The proposed fuel for the turbines and duct burners is pipeline-quality natural gas.
3/10/2016	18068/BOP150001	4/17/2018	NJ-0084	PSEG Fossil LLC Sewaren Generating Station	17.11	Emergency Engine	ULSD	Use of ULSD	NOx: 42.3 lb/hr FPM: 0.26 lb/hr PM_{10}: 0.26 lb/hr $PM_{2.5}$: 0.26 lb/hr	Diesel-fired emergency generator	PSEG Fossil LLC Sewaren Generating Station is located in Middlesex County, New Jersey. This project to be built at Sewaren would be a 1-on-1 (1 CT and a single steam turbine) combined-cycle electric generating unit including its ancillary equipment. The electric output of the CCCT at ISO conditions will be approximately 345 MW and the approximate output of the steam turbine at these conditions and with 100% supplemental heat input will be 240 MW.

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2/3/2016	3-1326-00275/ 00009	9/28/2017	NY-0103	Cricket Valley Energy Center	17.11	Emergency Engine (4020 HP)	ULSD	SCR and Good Combustion Practices	NOx: 2.11 g/HP-hr FPM: 0.15 g/HP-hr	The facility would include a natural gas-fired auxiliary boiler, four ULSD-fired black-start generator engines and a ULSD-fired emergency fire pump engine.	Cricket Valley Energy Center LLC constructed the Cricket Valley Energy Center (the Facility), a nominal net 1,000 MW combined-cycle gas turbine electric generating facility, on a site located in Dover, Dutchess County, New York. The Facility consists of three GE Model 7FA.05 CTGs operating in combined-cycle mode with supplemental firing of the HRSGs; natural gas will be the sole fuel fired in the CTGs and duct burners. In addition to the air emitting equipment, the Facility will include three STGs, an ACC and associated auxiliary equipment and systems. Each combined cycle generating unit consisting of the CTG, HRSG and STG will be exhausted through its own stack. Air emissions from the proposed Facility primarily consist of products of combustion from the CTGS, HRSG duct burners, and ancillary combustion sources.
1/22/2016	PSD-LA-769(M-1)	9/19/2016	LA-0292	Holbrook Compressor Station	17.11	Emergency Engines (1341 HP)	Diesel	Use of certified USEPA engine per NSPS IIII, use of ULSD, and good combustion practices based on the most recent manufacturer's specifications issued for these engines at the time that the engines are operating under this permit	NOx: 14.16 lb/hr $PM_{2.5}$: 0.44 lb/hr	Emergency generators no. 1 no. 2	Natural gas compressor station supporting the Cameron LNG Facility in Hackberry, Cameron Parish, Louisiana
1/7/2016	PSD-LA-747(M5)	4/28/2017	LA-0318	Flopam Facility	17.11	Generator Engine	Diesel	Compliance with NSPS IIII	Not Listed	Diesel engines	An existing chemical manufacturing facility
12/23/2015	35-00069A	12/21/2018	PA-0309	Lackawanna Energy Ctr./Jessup	17.11	Emergency Engine (2680 HP)	ULSD	None Listed	NOx: 5.45 g/HP-hr FPM: 0.025 g/HP-hr PM_{10}: 0.025 g/HP-hr $PM_{2.5}$: 0.025 g/HP-hr	Additional equipment includes: one 2,000 kW diesel-fired emergency generator, one 315 HP diesel-fired emergency fire water pump, one 184.8 MMBtu/hr natural gas fired boiler, one 12 MMBtu/hr natural gas fuel gas heater, two diesel fuel storage tanks, four lubricating oil tanks, one aqueous ammonia storage tank	This plan approval is for the construction and temporary operation of three identical GE Model 7HA.02 natural gas-fired CTs and HRSG with duct burners. Each CT/HRSG combined-cycle process block includes one combustion gas turbine and one HRSG with duct burners with all three CT/HRSG sharing one steam turbine. The entire power block is rated at 1,500 MW.
11/13/2015	PSC Case No. 9330	5/13/2016	MD-0045	Mattawoman Energy Center	17.21	Emergency Engines (1490 HP)	ULSD	Good combustion practices and exclusive use of ULSD	NOx: 4.78 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.18 g/HP-hr $PM_{2.5}$: 0.18 g/HP-hr	Emergency generator	990 MW combined-cycle natural gas-fired power plant

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9/1/2015	40-00129A	12/21/2018	PA-0311	Moxie Freedom Generation Plant	17.11	Emergency Engine	Diesel	None Listed	NOx: 4.93 g/HP-hr PM: 0.04 g/HP-hr PM_{10}: 0.04 g/HP-hr $PM_{2.5}$: 0.04 g/HP-hr	One fuel gas dew-point heater - natural gas fired; two CT inlet evaporative coolers; two ACCs; one auxiliary boiler, natural gas-fired; one diesel engine-powered emergency generator; one diesel engine-powered fire water pump; diesel fuel, lubricating oil, and aqueous ammonia storage tanks	The project is for the construction and operation of two identical 1 x 1 power blocks, each consisting of a CGT or CT and a steam turbine configured in single shaft alignment, where each CT and steam turbine train share one common electric generator. The turbines to be used for this project are two GE 7HA.02 CTS, each in 1 x 1 single shaft combined-cycle power islands. Each CT and duct burner will exclusively fire pipeline-quality natural gas. The HRSGs will be equipped with SCR to minimize NOx emissions and oxidation catalysts to minimize CO and VOC emissions from the CTs and duct burners. The project will also include several pieces of ancillary equipment.
6/4/2015	PSD-LA-774(M1)	4/28/2017	LA-0309	Benteler Steel Tube Facility	17.11	Emergency Engines (2922 HP)	Diesel	Compliance with NSPS IIII	NOx: 4.78 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency generator engines	A facility to produce 600,000 metric tons per year of seamless steel pipe from purchased billets. A steel production facility (including an electric arc furnace) was added.
4/1/2015	118239, N200	5/16/2016	TX-0728	Peony Chemical Manufacturing Facility	17.11	Emergency Engine (1500 HP)	Diesel	Use of certified USEPA Tier 2 engine and minimal hours or operation	0.0218 g/HP-hr FPM: 0.15 lb/hr FPM_{10}: 0.15 lb/hr $FPM_{2.5}$: 0.15 lb/hr	Emergency diesel generator	Ammonia production with hydrogen imported
1/23/2015	AQ1201CPT03	2/19/2016	AK-0082	Point Thomson Production Facility	17.11	Emergency Engines (2695 HP)	ULSD	None Listed	NOx: 4.8 g/HP-hr FPM_{10}: 0.15 g/HP-hr $FPM_{2.5}$: 0.15 g/HP-hr	Emergency camp generators	Oil gas exploration and production facility
					17.11	Bulk Tank Generator Engines (891 HP)	ULSD	None Listed	4.8 g/HP-hr FPM_{10}: 0.15 g/HP-hr $FPM_{2.5}$: 0.15 g/HP-hr	Bulk tank generator engines	
1/14/2015	160-11B	7/6/2016	MI-0418	Warren Technical Center	17.11	Emergency Engines (4676.6 HP)	Diesel	ITR is good design. Engines are tuned for low-NOx operation versus low CO operation	NOx: 5.97 g/HP-hr PM: Not Listed	Fg-backup generators (nine DRUPS emergency engines)	Automotive research
					17.11	Emergency Engines (3631.4 HP)	Diesel	ITR is good design. Engines are tuned for low-NOx operation versus low CO operation	NOx: 5.32 g/HP-hr PM: Not Listed	Four emergency engines in FG-BACKUPGENS	
12/1/2014	108446/PSDTX1352	3/6/2019	TX-0671	Project Jumbo	17.11	Emergency Engines (5360 HP)	ULSD	Use of certified USEPA Tier 2 engine	NOx: 4.05 g/HP-hr PM: Not Listed	Engines	Plastic Resin Manufacturing Plant
11/21/2014	R14-0030	5/1/2018	WV-0025	Moundsville Combined Cycle Power Plant	17.11	Emergency Engine (2015.7 HP)	Diesel	None Listed	Not Listed	Emergency generator	Nominal 549 MW (output) natural gas-fired combined cycle power plant.
11/5/2014	P0116610	2/25/2019	OH-0363	NTE Ohio, LLC	17.11	Emergency Engine (1474 HP)	Diesel	Compliance with NSPS IIII, emergency operation only, less than 500 hr/yr each for maintenance checks and readiness testing.	NOx: 29.01 lb/hr PM: 0.77 lb/hr PM_{10}: 0.77 lb/hr $PM_{2.5}$: 0.77 lb/hr	Emergency generator (P002)	Combined-cycle, natural gas-fired power plant

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10/31/2014	PSC CASE NO. 9297	5/13/2016	MD-0046	eys Energy Center	17.21	Emergency Engine (2010 HP)	ULSD	Good combustion practices, use of ULSD, and compliance with NSPS IIII and 40 CFR 63 Subpart ZZZZ	NOx: 4.78 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr	Two diesel-fired auxiliary generators (emergency generators), each rated at nominal 1,500 kW	735 MW combined-cycle natural gas-fired power plant
9/5/2014	13060007	5/5/2016	IL-0114	Cronus Chemicals, LLC	17.11	Emergency Engine (3755 HP)	Diesel	Use of certified USEPA Tier IV engines for non-road engines	NOx: 0.5 g/HP-hr FPM: 0.07 g/HP-hr PM_{10}: 0.07 g/HP-hr $PM_{2.5}$: 0.07 g/HP-hr	Emergency generator	Plant will produce urea and ammonia, but ammonia production will be limited to a maximum of 3 months of the year (4,880 tpd urea and 2,789 tpd ammonia).
7/22/2014	413-0033-X014 - X020	6/8/2016	AL-0301	Nucor Steel Tuscaloosa, Inc.	17.11	Emergency Engine (800 HP)	Diesel	None Listed	NOx: 6.8 g/HP-hr FPM: 0.32 g/hp-hr	Diesel fired emergency generator	Steel mill adding second baghouse to electric arc furnace, austenitizing furnace, tempering furnace, vacuum degasser, plasma torches, and emergency generators.
7/1/2014	PSC CASE NO. 9136	7/25/2016	MD-0043	Perryman Generating Station	17.11	Emergency Engine (1300 HP)	ULSD	Good combustion practices, limited hours of operation, and exclusive use of ULSD	NOx: 4.8 g/HP-hr PM_{10}: 0.17 g/HP-hr	Emergency generator	120 MW simple cycle natural gas fired power plant Perryman 6 project-wide emission limits: NOx = 58.5 tpy
6/9/2014	PSC CASE NO. 9318	5/14/2018	MD-0044	Cove Point LNG Terminal	17.11	Emergency Engine (1550 HP)	ULSD	Good combustion practices , designed to achieve emission limit, and exclusive use of ULSD	NOx: 4.8 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.17 g/HP-hr $PM_{2.5}$: 0.17 g/HP-hr	Emergency generator	Liquified natural gas processing facility and 130 MW generating station
6/4/2014	129-33576-00059	5/4/2016	IN-0173	Midwest Fertilizer Corporation	17.11	Emergency Engine (3600 HP)	Diesel	Use of good combustion practices	NOx: 4.46 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Diesel fired emergency generator	A stationary nitrogen fertilizer manufacturing facility
6/4/2014	129-33576-00059	5/5/2016	IN-0180	Midwest Fertilizer Corporation	17.11	Emergency Engine (3600 HP)	Diesel	Use of good combustion practices	NOx: 4.46 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Diesel fired emergency generator	A stationary nitrogen fertilizer manufacturing facility
5/23/2014	PSD-LA-778	9/14/2016	LA-0288	Lake Charles Chemical Complex	17.11	Emergency Engines (2682 HP)	Diesel	Use of certified USEPA engine per NSPS IIII and good combustion practices based on the most recent manufacturer's specifications issued for these engines at the time that the engines are operating under this permit	NOx: 27.37 lb/hr PM_{10}: 0.88 lb/hr $PM_{2.5}$: 0.88 lb/hr	Emergency diesel generators (EQTs 629, 639, 838, 966, 1264)	Not listed
5/23/2014	PSD-LA-779	4/28/2017	LA-0296	Lake Charles Chemical Complex LDPE Unit	17.11	Emergency Engines (2682 HP)	Diesel	Use of certified USEPA engine per NSPS IIII and good combustion practices based on the most recent manufacturer's specifications issued for these engines at the time that the engines are operating under this permit	NOx: 27.37 lb/hr PM_{10}: 0.88 lb/hr $PM_{2.5}$: 0.88 lb/hr	Emergency Diesel Generators (EQTs 622, 671, 773, 850, 994, 995, 996, 1033, 1077, 1105, 1202)	The low-density polyethylene (LDPE) unit will produce LDPE by the high pressure polymerization of ethylene.
5/23/2014	PSD-LA-781	3/16/2017	LA-0315	G2G Plant	17.11	Emergency Engine (5364 HP)	Diesel	Compliance with NSPS IIII and 40 CFR 63 Subpart ZZZZ, proper design and operation and use of ultra-low sulfur diesel	NOx: 52.58 lb/hr PM_{10}: 1.76 lb/hr $PM_{2.5}$: 1.76 lb/hr	Emergency diesel generator 1	The G2G plant will be a natural gas to gasoline production facility which will use natural gas to produce methanol that will be subsequently converted into gasoline.

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					17.11	Emergency Engine (5364 HP)	Diesel	Compliance with NSPS IIII and 40 CFR 63 Subpart ZZZZ, proper design and operation and use of ultra-low sulfur diesel	NOx: 52.58 lb/hr PM_{10}: 1.76 lb/hr $PM_{2.5}$: 1.76 lb/hr	Emergency diesel generator 2	
4/23/2014	PSC CASE NO. 9280	4/26/2018	MD-0041	CPV St. Charles	17.21	Emergency Engine (2010 HP)	ULSD	Good combustion practices, limited hours of operation, and exclusive use of ULSD	NOx: 4.8 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr	Emergency generator	725 MW combined-cycle natural gas-fired power plant
4/10/2014	R2-PSD 1	5/5/2016	PR-0009	Energy Answers Arecibo Puerto Rico Renewable Energy Project	17.11	Emergency Engine (670 HP)	ULSD	None Listed	NOx: 2.85 g/HP-hr FPM: 0.15 g/HP-hr	Emergency diesel generator	Energy Answers Arecibo is a new resource recovery facility capable of producing up to 77 MW of electrical power while combusting municipal solid waste, as the primary fuel.
4/8/2014	CPCN CASE NO. 9327	3/23/2018	MD-0042	Wildcat Point Generation Facility	17.11	Emergency Engine (3015 HP)	ULSD	Good combustion practices, limited hours of operation, and exclusive use of ULSD	NOx: 4.8 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency generator 1	1000 MW combined cycle natural gas-fired power plant facility-wide sulfuric acid mist emission limit = 96 tpy facility-wide CO_2 equivalent emission limit = 3,498,026 tpy
1/30/2014	NE-12-022	5/5/2016	MA-0039	Salem Harbor Station Redevelopment	17.11	Emergency Engine (1005 HP)	ULSD	None Listed	NOx: 4.8 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Two 315 MW GE Model 107F Series 5 CTGs, each with dedicated HRSG, duct burner and 31 MW STG, dispatchable independently of one another by ISO-NE; one 80 MMBtu/hr auxiliary boiler, one 750 kW emergency engine-generator, and one 371 BHP emergency engine-fire-pump.	Footprint Power Salem Harbor Development LP (the Permittee) proposes to construct and operate a nominal 630 MW natural gas fired, quick start (capable of producing 300 MW within 10 minutes of startup) combined cycle electric generating facility at Salem Harbor Station. With duct firing, the proposed facility will be capable of generating an additional 62 MW, for a total of 692 MW.
11/5/2013	P0113762	2/22/2019	OH-0360	Carroll County Energy	17.11	Emergency Engine (1490.08 HP)	Diesel	Compliance with NSPS IIII	NOx: 13.74 lb/hr PM_{10}: 0.49 lb/hr $PM_{2.5}$: 0.49 lb/hr	Emergency generator (P003)	Natural gas fired combined cycle gas turbine electric generating station of nominal capacity of 742 MW
11/1/2013	51-13	7/7/2016	MI-0406	Renaissance Power LLC	17.11	Emergency Engines (1340 HP)	Diesel	Use of good combustion practices	NOx: 4.8 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	FG-EMGEN7-8; Two 1,000 kW diesel-fueled emergency reciprocating ICEs	For technical questions regarding this permit contact the permit engineer.
9/26/2013	PSD-LA-767	4/28/2017	LA-0308	Morgan City Power Plant	17.11	Emergency Engine (2680 HP)	Diesel	Use of certified USEPA engine per NSPS IIII and good combustion and maintenance practices	NOx: 33.07 lb/hr FPM_{10}: 1.06 lb/hr $FPM_{2.5}$: 1.06 lb/hr	2000 kW diesel-fired emergency generator engine	Not listed
9/25/2013	147-32322-00062	5/4/2016	IN-0179	Ohio Valley Resources, LLC	17.11	Emergency Engine (4690 HP)	Diesel	Use of good combustion practices	NOx: 4.46 g/HP-hr FPM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Diesel-fired emergency generator	Nitrogenous fertilizer production plant

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7/2/2013	2008-302-C(M-1)PSD	7/29/2016	OK-0154	Mooreland Generating Station	17.11	Emergency Engine (1341 HP)	Diesel	Use of good combustion practices	NOx: 4.99 g/HP-hr $PM_{2.5}$: 0.44 lb/hr	Diesel-fired emergency generator engine	WFEC operates the Mooreland Generating Station to generate wholesale electricity which is transmitted over WFEC's system. The facility was originally constructed in 1963. The electricity is sold in rural areas of approximately 3/4 of the state of Oklahoma and part of New Mexico. The Mooreland Generating Station currently consists of three high-pressure boilers that burn locally-produced natural gas. The three high- pressure boilers used to generate electricity and the auxiliary boiler used to heat the facility were constructed before May 31, 1972 and are considered grandfathered from construction permitting requirements.
6/18/2013	P0110840	5/4/2016	OH-0352	Oregon Clean Energy Center	17.11	Emergency Engine (3015 HP)	Diesel	Compliance with NSPS IIII	NOx: 27.8 lb/hr PM_{10}: 0.99 lb/hr	Emergency generator	799 MW CCCT Power Plant
4/23/2013	37-337A	5/27/2016	PA-0291	Hickory Run Energy Station	17.11	Emergency Engine (1135 HP)	ULSD	None Listed	NOx: 9.89 lb/hr PM: 0.005 lb/hr	The project will also include a natural gas-fired auxiliary boiler; a diesel engine-driven emergency generator; a diesel engine-driven firewater pump; a multi- cell evaporative cooling tower; and associated emission control systems, tanks, and other balance of plant equipment.	Natural gas-fired combined-cycle electric generation facility that is designed to generate up to 900 MW nominal, using 2 CTGs and 2 HRSGs that will provide steam to drive a single STG. Each HRSG will be equipped with a duct burner which may be utilized at time of peak power demands to supplement power output.
3/27/2013	PSD-LA-768	5/4/2016	LA-0272	Ammonia Production Facility	17.11	Emergency Engines (1200 HP)	Diesel	Use of certified USEPA engine per NSPS IIII, limiting operational hours to 500 hr/yr, and good combustion practices	Not Listed	Emergency diesel generator (2205-B)	2780 ton per day ammonia production facility
3/18/2013	C-10656	8/25/2017	KS-0036	Westar Energy – Emporia Energy Center	17.11	Engine associated with fossil fuel power generation facility (900 HP)	Diesel	Use of good combustion practices	NOx: 14 lb/hr PM: 0.066 g/HP-hr PM_{10}: 0.066 g/HP-hr	Caterpillar C18DITA diesel engine generator	The Westar Energy – Emporia Energy Center (source id: 1110046) is a fossil fuel power generation facility located in Emporia, Kansas.
12/3/2012	141-31003-00579	5/4/2016	IN-0158	St. Joseph Energy Center, LLC	17.11	Emergency Engines (1006 HP)	Diesel	Use of good combustion practices and usage limits	NOx: 4.8 g/HP-hr FPM: 0.15 g/HP-hr FPM_{10}: 0.15 g/HP-hr $FPM_{2.5}$: 0.15 g/HP-hr	Two emergency diesel generators	Stationary electric utility generating station
					17.11	Emergency Engine (2012 HP)	Diesel	Use of good combustion practices and usage limits	NOx: 4.8 g/HP-hr FPM: 0.15 g/HP-hr FPM_{10}: 0.15 g/HP-hr $FPM_{2.5}$: 0.15 g/HP-hr	Emergency diesel generator	

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
11/1/2012	08857/BOP110001	4/17/2018	NJ-0080	Hess Newark Energy Center	17.11	Emergency Engine	ULSD	Use of ULSD	NOx: 18.53 lb/hr FPM: 0.59 lb/hr FPM_{10}: 0.66 lb/hr	Supporting ancillary equipment includes a natural gas fired auxiliary boiler, a 12-cell mechanical draft cooling tower, an emergency diesel generator and an emergency diesel fire pump.	Combined Cycle Electric Generating Facility Hess Newark Energy Center, proposed at Newark, New Jersey, would be a new, highly efficient, 655 MW combined-cycle power generating facility. Hess Newark Energy Center will consist of two GE CTGs with a heat input rate of 2,320 MMBtu/hr, that will utilize pipeline natural gas only. HRSGs downstream of the CTs will recover heat from the exhaust gases to generate steam. The HRSGs will be equipped with natural gas-fired duct burners for supplementary firing and will share a single STG.
10/26/2012	12-219	8/13/2013	IA-0105	Iowa Fertilizer Company	17.11	Emergency Engine (2680 HP)	Diesel	Use of good combustion practices	NOx: 4.48 g/HP-hr PM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency generator	Nitrogenous fertilizer manufacturing
10/10/2012	08Â·00045A	4/3/2015	PA-0278	Moxie Liberty LLC/Asylum Power PL T	17.11	Emergency Engine	Diesel	None Listed	NOx: 4.93 g/HP-hr PM_{10}: 0.02 g/HP-hr $PM_{2.5}$: 0.02 g/HP-hr	Emergency generator	Not listed
8/28/2012	CT-12636	5/11/2018	WY-0070	Cheyenne Prairie Generating Station	17.11	Emergency Engine (839 HP)	ULSD	Use of certified USEPA Tier 2 engine	Not Listed	Diesel emergency generator (EP15)	A nominal 220 MW gross electrical facility. The station is to consist of five 40 MW GE LM6000 CTGs with two of the turbines operating in combined cycle mode for an additional 20 MW in generation
8/20/2012	AQ1201CPT01	5/30/2013	AK-0076	Point Thomson Production Facility	17.11	Engine Associated With Oil Gas Exploration and Production (2345 HP)	ULSD	None Listed	NOx: 4.78 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Combustion of diesel by ICEs	Oil gas exploration and production facility
7/25/2012	18940 – BOP110003	4/17/2018	NJ-0079	Woodbridge Energy Center	17.11	Emergency Engine	ULSD	Use of ULSD	NOx: 21.16 lb/hr PM_{10}: 0.13 lb/hr $PM_{2.5}$: 0.13 lb/hr	Supporting ancillary equipment includes a natural gas fired auxiliary boiler, one small dew point fuel gas heater (fuel gas heater), a mechanical draft cooling tower, an emergency diesel generator and an emergency diesel fire pump.	Woodbridge Energy Center, proposed in Woodbridge Township, New Jersey, would be a new, highly efficient, 700 MW combined-cycle power generating facility. Woodbridge Energy Center will consist of two GE CTGs with a heat input rate of 2,307 MMBtu/hr, that will utilize pipeline natural gas only. HRSGs downstream of the CTs will recover heat from the exhaust gases to generate steam. The HRSGs will be equipped with natural gas-fired duct burners for supplementary firing and will share a single STG.
7/13/2012	160-11A	8/13/2013	MI-0395	Warren Technical Center	17.11	Emergency Engines (4033.4 HP)	Diesel	ITR is good design. Engines are tuned for low-NOx operation versus low CO operation	NOx: 4.46 g/HP-hr PM: Not Listed	Nine DRUPS emergency generators	Automotive research
					17.11	Emergency Engines (3350 HP)	Diesel	ITR is good design. Engines are tuned for low-NOx operation versus low CO operation	NOx: 5.32 g/HP-hr PM: Not Listed	Four emergency generators	
7/9/2012	2012–APP-002009	7/25/2017	CA-1219	City Of San Diego PUD (Pump Station 1)	17.11	Emergency Engine (2722 HP)	Diesel	Use of certified USEPA Tier 2 engines operational restriction of 50 hr/yr for maintenance and testing.	NOx: 4 g/HP-hr PM: Not Listed	IC engine	Not Listed

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
6/27/2012	T147-30464-00060	5/4/2016	IN-0166	Indiana Gasification, LLC	17.11	Emergency Engines (1341 HP)	Diesel	Use of good combustion practices and limited hours of non-emergency operation to 52 hr/yr	NOx: Not Listed PM_{10}: 15 PPM sulfur $PM_{2.5}$: 15 PPM sulfur	Two emergency generators	The permittee owns and operates a stationary substitute natural gas and liquefied CO_2 production plant.
6/1/2012	15-0027K	5/22/2018	PA-0282	Johnson Matthey Inc./Catalytic Systems Div.	17.11	Emergency Engine (871 HP)	Diesel	None Listed	NOx: 6.9 g/HP-hr PM: Not Listed	650 kW backup diesel generator	This plan approval has been issued to Johnson Matthey, Inc. To establish a plant-wide applicability limit for NOx emissions from the facility.
					17.21	Emergency Engine (536 HP)		Shall be fueled by No. 2 fuel oil with the sulfur content less than or equal to 0.2% by weight and limit operation to 50 hr/yr.	NOx: 6.9 g/HP-hr PM: Not Listed	400 kW diesel emergency generator	
6/1/2012	09-0142B	5/22/2018	PA-0292	ML 35 LLC/Phila Cybercenter	17.11	Emergency Engines (3017.25 HP)	Diesel	SCR	NOx: 0.5 g/HP-hr PM: 0.28 lb/hr	Diesel generator (2.25 MW each) – 5 units	Installation of five 2 MW electric generators with the associated storage tanks and air pollution control devices including SCR system and oxidation catalysts; conversion of six existing emergency generators to peak shaving generators; and a facility wide NOx emissions cap.
3/15/2012	6372-A1	7/29/2016	DC-0009	Blue Plains Advanced Wastewater Treatment Plant	17.11	Emergency Engine (2682 HP)	ULSD	None Listed	NOx: 5.39 g/HP-hr PM: Not Listed	Diesel emergency generator	Wastewater treatment plant using thermal hydrolysis pretreatment process prior to digesting wastewater sludge with anaerobic digesters. Digester gas is used as fuel for combined heat and power process
2/29/2012	160-11	8/13/2013	MI-0394	Warren Technical Center	17.11	Emergency Engines (3055.2 HP)	Diesel	ITR is good design. Engines are tuned for low-NOx operation versus low CO operation	NOx: 5.17 g/HP-hr PM: Not Listed	Four emergency generators	Automotive research
					17.11	Emergency Engines (4033.4 HP)	Diesel	ITR is good design. Engines are tuned for low-NOx operation versus low CO operation	NOx: 4.46 g/HP-hr PM: Not Listed	Nine DRUPS emergency generators	
2/8/2012	0160-0023	10/17/2012	SC-0113	Pyramax Ceramics, LLC	17.11	Emergency Engines (757 HP)	Diesel	Compliance with NSPS IIII	NOx: 2.99 g/HP-hr PM: Not Listed	Emergency generators 1 through 8	Pyramax ceramics plans to construct a manufacturing facility for the production of proppant beads for use in the oil and gas industry. The major raw material is clay. The clay is mixed with chemicals and then fired in a kiln to produce ceramic beads.
12/5/2011	2011-APP-001776	7/25/2017	CA-1221	Pacific Bell	17.11	Emergency Engine (3634 HP)	Diesel	Use of certified USEPA Tier 2 engines operational restriction of 50 hr/yr for maintenance and testing.	NOx: 3.5 g/HP-hr PM: Not Listed	ICE: emergency-CI	Not listed
11/17/2011	81-11	5/4/2016	MI-0402	ıpter Power Plant	17.11	Emergency Engine (732 HP)	Diesel	Use of good combustion practices	NOx: 4.85 g/HP-hr FPM: 0.05 g/HP-hr PM_{10}: 0.0573 lb/MMBTU $PM_{2.5}$: 0.0573 lb/MMBTU	Diesel fuel-fired combustion engine (RICE)	Utility–natural gas-fired CT
10/18/2011	SE 09-01	1/27/2014	CA-1212	Palmdale Hybrid Power Project	17.11	Emergency Engine (2683 HP)	Diesel	Use of ULSD	NOx: 4.78 g/HP-hr PM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency IC engine	570 MW natural gas fired combined cycle power plant with an integrated 50 MW solar thermal plant
10/3/2011	2011-APP-001787	7/25/2017	CA-1220	San Diego International Airport	17.11	Emergency Engine (1881 HP)	Diesel	Use of certified USEPA Tier 2 engines operational restriction of 50 hr/yr for maintenance and testing	NOx: 3.9 g/HP-hr PM: Not Listed	ICE: emergency-CI	Not listed

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
9/23/2011	PSD-FL-416, 0550063-001-AC	10/11/2012	FL-0332	Highlands Biorefinery And Cogeneration Plant	17.11	Emergency Engine (2680 HP)	ULSD	Compliance with NSPS IIII	NOx: 4.78 g/HP-hr PM: 0.15 g/HP-hr	2000 kW emergency equipment	This project involves the construction of a sugarcane and sweet sorghum-to-ethanol advanced biorefinery with a maximum annual ethanol production rate of 36 million gallons per year. The cane (i.e. the sugarcane and sorghum) will be grown on nearby farmland. The juice will be squeezed from the feedstock stalks, fermented, distilled and blended to make a range of ethanol/gasoline products, including e-85 (an 85/15 ethanol/gasoline blend). The leftover stalk fiber (bagasse) will be combusted in a cogeneration biomass boiler (458.5 MMBtu/hr on a 24-hour basis) to make process steam and up to 30 MW (gross) of electricity. In addition to bagasse, the boiler will use supplemental biomass consisting of energy crops, wood chips and vegetative debris. Natural gas will be used for startup, shutdown and flame stabilization and during a disruption in the biomass supply.
7/14/2011	AQ0215CPT03	11/18/2011	AK-0072	Dutch Harbor Power Plant	17.11	Rural Diesel-electric Power Plant Engineer (5896 HP)	ULSD	Turbocharger and Aftercooler and compliance with NSPS IIII	NOx: 7.31 g/HP-hr $FPM_{2.5}$: 0.37 g/HP-hr	Eu 15 caterpillar C280-16	Rural diesel-electric power plant
4/26/2011	PSD-LA-747(M1)	12/12/2011	LA-0251	Flopam Inc. Facility	17.11	Large Generator Engines (11 @ 591 HP, 1 @ 755 HP, 6 @ 1175 HP)	Diesel	None Listed	NOx: 6.32 lb/hr FPM_{10}: 0.01 lb/hr	Large Generator Engines (17 units)	A chemical manufacturing complex is under construction (PSD-LA-747 – LA0240). equipment is added or redesigned. (engines, cooling towers, material handling). Permit PSD-LA-747(M2) was issued July 5, 2012 for additional dust filters to control PM/PM_{10} from the permitted powder plants. similar dust filters were determined as BACT for same powder plants. No additional BACT analysis is required.
12/23/2010	PSD-FL-412 (0510032-001-AC)	7/6/2011	FL-0322	Sweet Sorghum-To-Ethanol Advanced Biorefinery	17.11	Emergency Engines (2682 HP)	ULSD	Compliance with NSPS IIII	NOx: 4.78 g/HP-hr PM: 0.15 g/HP-hr	Emergency generators, two at 2682 HP each	The SRF facility will be located just east of County Road 835 at the intersection with Hill Grade Road and approximately 13 miles south southwest of Clewiston/Lake Okeechobee in Hendry County. Hendry County is bounded by Lee County to the west, Glades County to the north, Collier County to the south, Palm Beach County to the east and Broward County to the southeast. Lake Okeechobee is located immediately northeast of Hendry County. The Big Cypress Seminole Indian Reservation is located approximately 18 miles south southeast of the site entrance. Most of Hendry County is agricultural.
12/20/2010	AQ0164CPT01	3/27/2012	AK-0071	International Station Power Plant	17.11	Combined Cycle Power Plant Engine (2010 HP)	ULSD	Turbocharger ,aftercooler, and good combustion	NOx: 4.78 g/HP-hr PM: 0.03 g/HP-hr PM_{10}: 0.03 g/HP-hr $PM_{2.5}$: 0.03 g/HP-hr	Caterpillar 3215c black start generator (1)	Combined cycle power plant
12/20/2010	AQ0164CPT01	1/8/2014	AK-0073	International Station Power Plant	17.11	Black Start Engine (2010 HP)	Diesel	Turbocharger and Aftercooler	NOx: 4.78 g/HP-hr PM_{10}: 0.03 g/HP-hr	Fuel combustion	Power plant that contains four CTs, four duct burners, a black start generator, and an auxiliary heater.
6/29/2010	28.0505-PSD	3/23/2018	SD-0005	eer Creek Station	17.11	Emergency Engine (2680 HP)	Diesel	Compliance with NSPS IIII	Not Listed	Emergency generator	Natural gas-fired CT and HRSG for electricity production. The facility has a maximum net output of 300 MW.

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
6/25/2010	P-2009.0092	10/5/2010	ID-0018	Langley Gulch Power Plant	17.11	Emergency Engine (1005 HP)	Diesel	Use of certified USEPA Tier 2 engine and good combustion practices	NO_x: 4.78 g/HP-hr PM: 0.15 g/HP-hr	Ancillary equipment includes one diesel-fired emergency generator, one diesel-fired fire pump, one wet cooling tower, and six dry chemical storage silos	One-on-one combined cycle plant consisting of one natural gas-fired CT and one steam turbine. The CT is equipped with one HRSG and duct burner. Ancillary equipment includes one diesel-fired emergency generator, one diesel-fired fire pump, one wet cooling tower, and six dry chemical storage silos.
3/11/2010	SE 07-02	12/14/2017	CA-1191	Victorville 2 Hybrid Power Project	17.11	Emergency Engine (2680 HP)	Diesel	Operational Restriction of 50 hr/yr	NO_x: 4.48 g/HP-hr PM: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency engine	563 MW power plant comprised of a hybrid of natural gas-fired combined cycle generating equipment integrated with solar thermal components

Notes:

ACC = air-cooled condenser
BHP = brake horsepower
CCCT = combined-cycle combustion turbine
CT = combustion turbine
CTG = combustion turbine generator
FRAP = Flat Rock Assembly Plant
GE = General Electric
hr/yr = hour per year
HRSG = heat recovery steam generator
ITR = ignition timing retardation
lb/MMBtu = pounds per million British thermal units
LNG = liquefied natural gas
MMBtu/hr = million British thermal units per hour
PVC = polyvinyl chloride
STG = steam turbine generator
tpd = tons per day

Table 4-5. RLBC Database (Small Diesel Internal Combustion Engines (< 500 HP))

Permit Date	Permit No.	Last Updated	Determination Number	Facility Name	Process Code	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
5/2/2018	PSD-LA-709(M-3)	2/19/2019	LA-0328	Plaquemines Plant 1	17.21	Emergency Engines (375 HP)	Diesel	Good combustion practices and compliance with NSPS IIII	NOx: 2.99 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency Diesel Engine Pump P-39A	PVC production
					17.21	Emergency Engines (300 HP)	Diesel	Good combustion practices and compliance with NSPS IIII	NOx: 2.99 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Emergency Diesel Engine Pump P-39B	
2/23/2018	063-37891-00037	2/19/2019	IN-0295	Steel Dynamics, Inc. - Engineered Bar Products Division	17.21	Emergency Engine (2 at 75 HP, 1 at 150 HP)	Diesel	None Listed	NOx: 14.06 g/HP-hr FPM: 1.0 g/HP-hr PM_{10}: 1.0 g/HP-hr	Emergency Diesel Generators 2 units at 75 HP, 1 unit at 150 HP	Steel Mini Mill
					17.21	Emergency Engines (250 HP)	Diesel	None Listed	NOx: 6.87 g/HP-hr PM_{10}: 1.0 g/HP-hr	Emergency Diesel Generators 2 units	
1/9/2017	PSD-LA-890	5/11/2018	LA-0323	Monsanto Luling Plant	17.21	Emergency Engine (400 HP)	Diesel	Proper operation practices, compliance with NSPS 40 CFR 60 Subpart IIII, and limits of hours of operation.	NOx: Not Listed FPM: Not Listed PM_{10}: Not Listed	Standby Generator No. 9 Engine Operating hours limited to 100 hr/yr for ready testing.	Chemical Manufacture
8/3/2016	PSD-LA-813	4/28/2017	LA-0314	Indorama Lake Charles Facility	17.21	Emergency Engines (350 HP)	Diesel	Compliance with 40 CFR 63 Subpart ZZZZ	NOx: Not Listed FPM: Not Listed PM_{10}: Not Listed	Diesel emergency generator engine - EGEN	Modify and restart-up a mothballed facility to produce 1,009 million lbs/yr of ethylene
7/19/2016	19149/ PCP150001	11/3/2016	NJ-0085	Middlesex Energy Center, LLC	17.21	Emergency Engine	Diesel	Limited hours of operation and exclusive use of ULSD	NOx: 20.6 lb/hr FPM: 0.661 lb/hr PM_{10}: 0.661 lb/hr	Emergency generator diesel	New 633 MW gross facility consisting of one GE 7HA.02 CCCT nominally rated at 380 MW at ISO conditions without duct firing with a maximum heat input rate of: 3,462 MMBtu/hr (HHV) at 0 degrees Fahrenheit, 100% load combusting natural gas -- 3,613 MMBtu/hr (HHV) at 0 degrees Fahrenheit, 100% load combusting ULSD which would be the backup fuel. Other equipment includes: one natural gas-fired duct burner (maximum heat input of 599 MMBtu/hr [HHV]) for supplemental firing; one 97.5 MMBtu/hr (HHV) natural gas fired auxiliary boiler, equipped with low NOx burners and flue gas recirculation for control of NOx emissions; one 2.25 MMBtu/hr (HHV), 327 BHP, ULSD-fired emergency fire pump; one 14.4 MMBtu/hr (HHV), approximately 1,500 kW ULSD-fired emergency generator; and one 8-cell, 124,800 gallons per minute mechanical induced draft cooling tower.
1/23/2015	MD-12620	2/19/2016	AK-0082	Point Thomson Production Facility	17.21	Airstrip generator engine (490 HP)	ULSD	None Listed	NOx: 4.8 g/HP-hr FPM_{10}: 0.15 g/HP-hr $FPM_{2.5}$: 0.15 g/HP-hr	One 490 HP airstrip generator engine	Oil gas exploration and production facility
					17.21	Agitator generator engine (98 HP)	ULSD	None Listed	NOx: 5.6 g/HP-hr FPM_{10}: 0.3 g/HP-hr $FPM_{2.5}$: 0.3 g/HP-hr	Agitator generator engine ULSD-fired 98 HP	
					17.21	Incinerator generator engine (102 HP)	ULSD	None Listed	NOx: 4.9 g/HP-hr FPM_{10}: 0.22 g/HP-hr $FPM_{2.5}$: 0.22 g/HP-hr	Incinerator generator engine ULSD-fired 102 HP	

1/23/2014	102482, PSDTX1292	5/16/2016	TX-0706	Natural Gas Fractionation	17.21	Emergency engines	ULSD	None Listed	NOx: 0.33 tpy PM: Not Listed	Emergency Engines	Occidental will build an NGL Fractionation Plant that will receive natural gas liquids by pipeline and fractionate these liquids into commercial grade products, including ethane, propane, butanes, and natural gasoline
10/15/2012	MD-12620	4/14/2016	WY-0071	Sinclair Refinery	17.21	Emergency air compressor (400 HP)	ULSD	Use of certified USEPA Tier 3 engine	Not Listed	Emergency Air Compressor	Crude Oil Refinery
8/23/2012	2012--APP-002157	7/25/2017	CA-1217	Bea San Diego Ship Repair	17.21	Generator engine (450 HP)	Diesel	None Listed	NOx: 1.34 g/HP-hr FPM: Not Listed PM_{10}: Not Listed	ICE - 450 BHP Model QSX15-C - Cummins	
2/8/2012	0160-0023	10/17/2012	SC-0113	PyramAx Ceramics, LLC	17.21	Emergency engines (29 HP)	Diesel	Use of certified USEPA engine	NOx: 5.6 g/HP-hr FPM: Not Listed PM_{10}: Not Listed	Emergency engines 1 through 8	Pyramax ceramics plans to construct a manufacturing facility for the production of proppant beads for use in the oil and gas industry. The major raw material is clay. The clay is mixed with chemicals and then fired in a kiln to produce ceramic beads. Initial construction permit for a greenfield facility.
10/18/2011	SE 09-01	1/27/2014	CA-1212	Palmdale Hybrid Power Project	17.21	Emergency Engine (182 HP)	Diesel	NOx: None Listed PM: use of ultra-low sulfur fuel	NOx: 2.99 g/HP-hr PM: 0.15 g/HP-hr PM_{10}: 0.15 g/HP-hr $PM_{2.5}$: 0.15 g/HP-hr	Unit is 135 kW	570 MW natural gas fired combined cycle power plant with an integrated 50 MW solar thermal plant

Table 4-6. California BACT Clearinghouse Determination Summary (CARB and SCAQMD)

Permit Date	Permit No.	Last Updated	Facility Name	Equipment Description	Fuel	LAER/BACT Control Method Determination	Emission Information	Equipment Detailed Description	Extended Facility Description
2/1/2019	A/N 594294	2/1/2019	Sunshine Canyon Landfill	Emergency Portable CI Diesel Engine (123.4 HP)	Diesel	Tier 4 Final Limits. CI naturally aspirated with SCR, oxidation catalyst, and ammonia oxidation catalyst.	NOx: 2.5 g/HP-hr PM/PM_{10}: 0.01 g/HP-hr	Caterpillar Portable IC Engine Model C4.4	Drives landfill refuse truck tipper which powers a hydraulic pump that raises and lowers two hydraulic cylinders and tipper platform.
12/10/2015	A/N 516409	12/2/2016	U.S. Government VA Medical Center	Emergency CI Diesel Engine (374 HP)	Diesel	Turbocharger and aftercooler. Limited to 200 hr/yr which includes no more than 50 hr/yr and 4.2 hour/month for maintenance and testing. Engine shall not be operated in idle mode for more than 240 consecutive minutes. Diesel particulate filter required to reduce toxic risk from diesel particulate emissions, but also reduces PM_{10}.	NOx+VOC: 3 g/HP-hr PM/PM_{10}: 0.15 g/HP-hr	Caterpillar IC Engine Model C9	Drives an emergency electricity generator.
12/10/2015	A/N 558397	12/2/2016	University of Southern California	Emergency CI Diesel Engine (755 HP)	Diesel	Turbocharger and aftercooler. Limited to 200 hr/year which includes no more than 50 hr/yr and 4.2 hours per month for maintenance and testing. Diesel particulate filter required to reduce toxic risk from diesel particulate emissions, but also reduces PM_{10}	NOx+VOC: 4.8 g/HP-hr PM/PM_{10}: 0.01 g/HP-hr PM or PM_{10}	Cummins IC Engine Model QSX15-G9	Drives an emergency electricity generator.
12/10/2015	A/N 516708	12/2/2016	Los Angeles County Sheriff's Department	Emergency CI Diesel Engine (2,220 HP)	Diesel	Turbocharger and aftercooler. Limited to 200 hr/yr which includes no more than 50 hr/yr and 4.2 hours per month for maintenance and testing. Diesel particulate filter required to reduce toxic risk from diesel particulate emissions, but also reduces PM_{10}.	NOx+VOC: 4.8 g/HP-hr NOx+VOC: PM/PM_{10}: 0.15 g/HP-hr PM or PM_{10}	Cummins IC Engine Model QSK50-g4	Drives an emergency generator.
8/23/2012	2012-APP-002157	8/23/2012	BAE San Diego Ship Repair	Prime engine driving a track mounted crane at a stationary source (450 HP)	Diesel	Subject to a 37,000-gallon per year fuel limit. BACT for NOx determined to be an USEPA certified current tier engine (interim tier 4). SCR determined not feasible due to too-low exhaust temperatures.	NO_X: 1.8 g /HP-hr	Cummins IC Engine Model QSX15-C	This was a replacement. Lifting equipment and supplies at a ship repair yard
07/09/2012	2012-APP-002009	07/09/2012	City of San Diego PUD (Pump Station 1)	Two backup engines for a sewage pump station (2,722 HP)	Diesel	No add-on controls, but certified engine includes turbocharger and charge air cooler. SCR determined to be not technologically feasible.	NO_X: 4 g/HP-hr	Caterpillar IC Engine Model 3516C	Provide backup power for a sewage pump terminal
12/5/2011	2011-APP-001776	12/5/2011	Pacific Bell	Emergency Diesel Engine driving a 2.5 MW generator (3,634 HP)	Diesel	No add-on controls, but certified engine includes turbocharger and charge air cooler. SCR determined to be not technologically feasible. Propane or natural gas-fired engine not cost effective. Passed an AQIA for NO_2 impacts.	NO_X: 3.5 g/HP-hr	Caterpillar IC Engine Model 3516DITA	Provide backup power to an office complex
10/3/2011	2011-APP-001787	10/3/2011	San Diego International Airport	Emergency diesel engine equipped with a Johnson Matthey DPF (1,881 HP)	Diesel	No add-on controls, but certified engine includes turbocharger and charge air cooler. SCR determined to be not technologically feasible. Propane or natural gas-fired engine not cost effective.	NO_X: 3.9 g/HP-hr	Mitsubishi IC Engine Model S12R-Y2PTAW-1	Provide backup power for an airport terminal
8/2/2006	A/N C-1010958	8/2/2006	Kings County Department of Public Works	Emergency CI Diesel Engine (2,848 HP)	Diesel	Engine must be equipped with turbocharger, aftercooler, positive crankcase ventilation or 90% control of crankcase emissions, and oxidation catalyst/particulate filter. Operation is restricted to 614 hr/yr. Emission limits (g/BHP-hr): NOx-5.187	NOx: 5.187 g/HP-hr PM_{10}: 0.0116 g/HP-hr	Caterpillar IC Engine Model 3516B	Drives electric generator used for emergency and peaking power. Enables facility to be on Southern California Edison interruptible rate schedule.
5/16/2006	11971	5/16/2006	Cottage Health Care - Pueblo Street	Emergency/Standby Diesel IC Engine (2,937 HP)	Diesel	Certified Tier 2 engine. Maintenance and testing limited to 50 hr/yr. Unlimited emergency use	NO_X: 4.5 g/HP-hr PM: Not listed	4 Caterpillar IC Engines Model 3516C	
8/26/2003	418235	8/26/2003	Snow Summit, Inc.	Diesel engine (2,835 HP)	Diesel	Turbocharged, aftercooled, lean-burn. Permit limits were considered BACT. The NOx BACT limits were based on maximum emissions estimated by the catalyst vendor. Comments App. No.: 418235 SCAQMD's Clean Fuels Policy would normally require a stationary, non-emergency engine to be natural gas- fired. However, natural gas is not available in this mountain community.	NOx: 50 g/HP-hr PM_{10}: 0.045 g/HP-hr	Cummins IC Engine Model QSK78-G6	
8/25/2003	A/N 418235	8/6/2004	Snow Summit	Stationary Engine, Non-Emergency Diesel (2,835 HP)	Diesel	SCR catalyst, turbocharged, aftercooled, lean burn. Parts per million by volume, dry at 15% O_2: NOx -50 g/BHP-hr. Operation restricted to 1600 hr/yr. Source test initially and every 3 years. Continuous NOx monitor (not CEMS).	NOx: 50 g/HP-hr PM_{10}: 0.045 g/HP-hr	Cummins IC Engine Model QSK78-G6	Provides power for snow making equipment.

5.0 AIR QUALITY MODELING ANALYSIS

Impacts of criteria pollutant emissions from the Project were modeled for comparison to the NAAQS and PSD increments. The guidance of the USEPA Guideline on Air Quality Models (40 CFR Part 52, Appendix W) was used as well as MDE guidance where applicable.

In the New Source Review (NSR) Workshop Manual (EPA, 1990) the dispersion modeling analysis is separated into two distinct phases: 1) the preliminary analysis, and 2) a full impact analysis. In the preliminary analysis, the potential emissions from the project are modeled to determine the criteria pollutants which need a full impact analysis. Those pollutants for which the modeled maximum impact are below the SILs would not require a full impact analysis.

The modeling methodology used for assessing the Proposed Facility's air quality impact is detailed in the following:

- Revised Air Quality Modeling Protocol submitted to the MDE on March 10, 2023.
- Responses to MDE's comments letter (dated July 27, 2023) to the revised version of the Air Quality Modeling Protocol submitted on March 10, 2023.

A copy of US Wind's response to MDE comments can be found in the agency correspondence (Appendix B-3).

5.1 Background Ambient Air Quality

The model results from the preliminary analysis are added to the background concentration before comparison to the NAAQS. Background concentrations are based on monitoring locations in Maryland, Virginia, Delaware, and New Jersey. In each state there are major cities and rural areas. The setting for the Project is adjacent to the beaches along the Delaware and Maryland shores where there are no significant stationary emission sources. Given the over-water environment of the Lease Area, utilization of these predominantly urban and suburban monitoring locations for the background concentrations is conservative in nature.

The air quality modeling protocol (Appendix B-3) provides the description and locations of the background air quality monitors. The background concentration from the nearest monitor for each pollutant are presented in Table 5-1.

5.1.1 Monitoring Waiver

A waiver from pre-construction ambient air quality monitoring may be granted when an applicant makes an acceptable showing that:

1. Representative existing ambient air monitoring data exists in the affected area and is of the quality and nature which demonstrates the current conditions of the area's air quality; or
2. Representative ambient air monitoring data exists from a prior time period which can be demonstrated to be conservative (i.e., higher) in establishing the current conditions of the area's air quality.

To determine whether pre-construction monitoring should be considered, the maximum impacts attributable to the proposed project are assessed against significant monitoring concentrations (SMC). The SMC for the applicable averaging periods for CO, SO_2, NO_2, and PM10 are provided in 40 CFR §52.21(i)(5)(i). A preconstruction air quality analysis using continuous monitoring data may be required for pollutants subject to PSD review per 40 CFR §52.21(m). If either the predicted modeled impact from an emissions increase or the existing ambient concentration is less than the SMC, an applicant may be exempt from pre-construction ambient monitoring. Regardless of this point, US Wind is not relying upon an SMC, or another exemption, from the requirement to collect and evaluate ambient air quality data. Specifically, US Wind asserts that the existing ambient monitoring program operated by MDE, DNREC, and NJDEP is sufficient to meet the needs of any pre-construction monitoring requirements and thus may be used in lieu of source specific preconstruction monitoring requirements.

See also, 40 CFR 52.21.1670 ("applicant makes an acceptable showing that representative existing ambient monitoring data exists in the affected area of the quality and nature which demonstrates the current conditions of the air quality of the area"); and New Source Review Workshop Manual (Draft, October 1990) at C.18 ("To be acceptable, such data must be judged by the permitting agency to be representative of the air quality for the area in which the proposed project would construct and operate"). As discussed in Section 5.1, representative data satisfying these requirements exists.

US Wind is requesting a waiver from the requirement to perform pre-application ambient air quality monitoring for CO, NO_2, PM10, and PM2.5 because there exists acceptable quality assured ambient air quality data from alternate locations that satisfy the requirements of 40 CFR 52.21.1670. Further, US Wind is requesting an exemption from the requirement to perform pre-application ambient monitoring for SO_2 and lead because they will be emitted in amounts less than the SERs; for fluorides, hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds because they are not anticipated to be emitted from the Project; and for H_2SO_4 because there is no approved monitoring technique available.

5.2 Modeling Methodology

5.2.1 Model Selection

The USEPA guideline model for the modeling of the Project is the Offshore and Coastal Dispersion Model (OCD) (v5). The model, as described in 40 CFR Part 50, Appendix W and the OCD User's Guide is downloaded from the USEPA website SCRAM for use along with several preprocessors. It is a straight line steady-state Gaussian model which predicts hourly average concentrations based on hourly input meteorology and hourly emissions from the modeled sources.

The air quality model for over-water impacts is the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) Modeling System with meteorological data prepared using the AERCOARE meteorological data preprocessor program. AERCOARE is used to implement the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm. US Wind requested from USEPA to use AERMOD in conjunction with AERCOARE prepared meteorological data (AERCOARE-AERMOD) as an alternative model for assessing compliance with air quality standards for the Project emission sources located over water in lieu of the OCD model, which is the Guideline on Air Quality Models (40 CFR 51 Appendix W) preferred model for over-water dispersion. The revised air quality modeling protocol submitted to MDE on March 10, 2023 includes a detailed description of the AERCOARE-AERMOD modeling methodology.

5.2.2 Meteorological Data

For any air quality modeling analysis conducted using the AERMOD model, two meteorological datasets are required: 1) hourly surface data and 2) upper air sounding data. According to the Guideline on Air Quality Models (Revised) (2017), the meteorological data used in an air quality modeling analysis should be selected based on its spatial and climatological representativeness of a proposed facility site and its ability to accurately characterize the transport and dispersion conditions in the area of concern. The spatial and climatological representativeness of the meteorological data are dependent on four factors:

1. The proximity of the meteorological monitoring site to the area under consideration;
2. The complexity of the terrain;
3. The exposure of the meteorological monitoring site; and,
4. The period of time during which data were collected.

The modeling analysis used prognostic meteorological data. This is appropriate because there is no representative National Weather Service (NWS) station and given the offshore nature of the Projects it is infeasible to collect adequately representative site-specific data. In addition, there are only two active buoys that collect meteorological data in the area, the Ocean City Inlet Buoy and the Delaware Bay 26 NM Buoy (ID #44009), which is 19 miles offshore of Ocean City. To run AERCOARE, the overwater meteorological file contains the necessary hourly observations to estimate surface fluxes using the COARE algorithm, plus additional variables that are directly passed through to AERMOD. Buoy data can be used with AERCOARE, provided that it meets

USEPA completeness requirements described under section 8.4.3 of Appendix W (at least 90% annual and at least 90% per calendar quarter, on average, across the 5 years processed).

The minimum set of overwater observations for the COARE algorithm must include wind speed, air temperature, sea temperature, and relative humidity. As an alternative to measured data, the USEPA MMIF program can also be applied to create an overwater meteorological file suitable for AERCOARE using simulations from WRF.

As discussed in the air quality modeling protocol (Appendix B-3), US Wind assessed a recent five year period (2017-2021) of meteorological data collected at the Ocean City Inlet Buoy and the Delaware Bay 26 NM Buoy, offshore of Ocean City. Neither of these buoys collect the relative humidity data that are necessary inputs to AERCOARE. In addition, the annual capture statistics were calculated from the period 2017-2021 and it was determined that the primary meteorological variables had capture statistics ranging from 88.6 to 92.7% for the Ocean City Inlet Buoy and from 38% to 64% for the Delaware Bay Buoy. Thus, the meteorological data from the nearest buoys does not meet the USEPA minimum criteria for completeness requirements on an annual basis. Based on the poor capture criteria statistics and absence of relative humidity data, the two buoys are not suitable for use with the AERCOARE model.

As such, US Wind has requested and received prognostic (i.e., WRF data) data from USEPA Office of Air Quality Planning and Standards (OAQPS). USEPA processed the WRF data using the MMIF (Version 4.0) to convert the WRF prognostic meteorological data (2019-2021) into a format suitable for dispersion modeling applications. The USEPA utilized the default settings for AERCOARE processing as provided in the User's Manual to the Mesoscale Model Interface Program, Version 4.0 (June 9, 2022). Note that setting options specific to AERMET processing, such as AER_MIXHT and AER_MIN_SPEED, are not applicable to AERCOARE processing.

US Wind ran AERCOARE using the following settings recommended in USEPA's AERCOARE User's Guide, as specified below:

1. The default threshold wind speed will be used to identify calm hours (i.e., WSCALM = 0.5 m/s). Wind speeds below this value will be considered calms;
2. Mixing heights provided by WRF-MMIF will be used, instead of calculated by AERCOARE. The default minimum mixing height of 25 meters will be assigned;
3. Warm layer and cool-skin effects will not be considered; and
4. Friction velocity will be determined from wind speed only; wave-height will not be considered.

Use of prognostic meteorological data requires concurrence from the appropriate reviewing authority and collaborating agencies that the data are of acceptable quality and representative of the modeling application. A concurrence request for approval from the USEPA and MDE is provided in the agency correspondence in Appendix B-2. The output from AERCOARE was used as the meteorological database for the modeling analysis and consists of a surface data file and a vertical profile data file.

5.2.3 AERMOD Model Options

AERCOARE-AERMOD (version 23132) was used for the modeling of the proposed Project's potential emissions to determine the maximum ambient air concentrations. The regulatory default option was used in the dispersion modeling analysis.

5.2.4 Good Engineering Practice Stack Height

Section 123 of the Clean Air Act (CAA) Amendments required the USEPA to promulgate regulations to assure that the degree of emission limitation for the control of any air pollutant under an applicable State Implementation Plan (SIP) was not affected by (1) stack heights that exceed Good Engineering Practice (GEP) or (2) any other dispersion technique. The USEPA provides specific guidance for determining GEP stack height and for determining whether building downwash will occur in the Guidance for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations), (EPA-450/4-80-023R, June, 1985). GEP is defined as "...the height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, and wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles."

The GEP definition is based on the observed phenomenon of atmospheric flow in the immediate vicinity of a structure. It identifies the minimum stack height at which significant adverse aerodynamics (downwash) are avoided. The USEPA GEP stack height regulations specify that the GEP stack height be calculated in the following manner:

$$H_{GEP} = H_B + 1.5L$$

Where: H_B = the height of adjacent or nearby structures, and
L = the lesser dimension (height or projected width of the adjacent or nearby structures).

Structure downwash would be incorporated into the AERMOD model by specifying a structure height and width that are nearby a specific source and could influence dispersion from that source. The main structure for scenarios that could influence dispersion is the OSS platform. While the AERMOD model does not incorporate platform downwash using a platform downwash algorithm based on laboratory experiments, US Wind used PRIME, considering the platform as a solid structure which would result in conservative, overprediction of concentrations. The final design of the OSS has not yet been determined but based on information provided by US Wind to BOEM in the Construction and Operations Plan (COP), the

OSS topside dimensions are anticipated to range from 30 m by 43 m and 50 m high up to 40 m by 80 m and 60 m high. The air quality modeling was prepared based on a platform dimension of 40 m by 80 m with design heights ranging from 50 m to 60 m. The maximum modeled concentrations from either platform design height were then selected as worst-case impacts. The structure dimensions and associated downwash are conservative in that it assumes a solid foundation down to sea level, instead of the OSS being several meters above sea level on the monopile foundations.

These downwash dimensions were also assigned to the jack-up vessels and the supply barges as these vessels will likely be attached or near the OSS structure during construction and large-scale repairs during O&M and therefore be potentially influenced by its wake effects. The diesel electric generator may be located on top of the OSS platform and therefore may be subject to its influence as well. The crew transport vessels are assumed to be transiting to or from the platform such that their emissions release point is mostly independent of the platform wake, and therefore downwash effects were not assigned to these vessels. Table A-45 provides a detailed matrix of emission sources and if downwash was modeled for each scenario. In summary, downwash dimensions were assigned to all vessels involved in OSS construction that may be attached to or near the OSS platform.

5.2.5 Receptor Grid

When assessing compliance with NAAQS and Class II PSD increments, the receptors in closest proximity to the emission sources are mostly over water. There cannot possibly be any residences over water, and the public is extremely unlikely to remain for any extended period in any of the overwater locations being modeled. The standards were established to be protective of public health based on repeated or prolonged exposure, and the possibility of repeated or prolonged exposure does not exist miles offshore.

For NAAQS and PSD Class II increment modeling, a polar grid of receptors was utilized in which receptors are placed in 10-degree increments around the ring. Receptor ring spacing were 25 m out to 1000 m, 250 m out to 2,500 m, 500 m out to 5,000 m, 2.5 km out to 10 km, and 5 km out to 50 km. Based on the results of the modeling with maximum impacts located within 1000 m, the receptor field did not need refined to ensure that the maximum impacts from the different construction and O&M activities are being captured. It should be noted that the receptors are nearly entirely over water, in locations where there are no residences, and where the public is unlikely to remain for any extended period of time.

The modeled receptors varied based on the type of construction and O&M activity. For example, during construction, it is assumed that a 500-meter exclusion zone will be established to keep the public away from the immediate area of the activity. The details of the safety zone are provided in the Project's *Navigation Safety Risk Assessment* (US Wind, May, 2022) that has been provided to the BOEM as part of the Construction and Operations Plan (COP). The receptor field was placed adjacent to the activity in areas where the public could have access. For the purposes of modeling, it is assumed that the construction vessels are located at the center of the receptor grid and the exclusion zone is 500 m in all directions.

For PSD Class I modeling, receptors were placed at a distance of 50 km to conservatively model the impacts at the Brigantine NWR. A ring of polar receptors was placed 50 km from the centroid of the WDA. Receptors were placed at each degree, for a total of 360 receptors. This methodology is very conservative as it models the Brigantine NWR at all wind directions at 50 km from the centroid of the WDA.

5.3 NO_2 Modeling

The following tiered screening options were applied for the various analyses per the guidance specified in the "Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter", published final in the Federal Register on January 17, 2017, and the USEPA Memorandum "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" section entitled Approval and Application of Tiering Approach for NO_2 (found on pages 5 through 8 of the memorandum). Section 5.2.4 of the USEPA's Guideline on Air Quality Models, Appendix W to 40 CFR Part 51, recommends a three-tiered screening approach to estimate ambient concentrations of NO_2:

- Tier 1 – assume complete conversion of all emitted NO to NO_2;
- Tier 2 – multiply Tier 1 results by a representative equilibrium NO_2/NO_x ratio; and
- Tier 3 – perform a detailed analysis on a case-by-case basis.

The 1-hour NO_2 modeling analysis utilized the USEPA Tier 3 modeling approach for 1-hour NO_2 modeling assessment results using the AERMOD Plume Volume Molar Ratio Method (PVMRM) that adjusts NO_x emissions to estimate more realistic ambient NO_2 concentrations by modeling the conversion of NO_x to NO_2. Note that the Tier 2 screening approach using the Ambient Ratio Method 2 (ARM2) is too conservative for this Project.

PVMRM incorporates three sets of data into the calculation of 1-hour NO_2 concentrations. Those are source-specific in-stack NO_2/NO_x emission rate ratios, an ambient NO_2/NO_x concentration ratio, and hourly average background ozone concentrations.

The PVMRM option for modeling conversion of NO to NO_2 incorporated a default NO_2/NO_x ambient equilibrium concentration ratio of 0.90.

5.3.1 In Stack NO_2/NO_x Concentration Ratio

NO_x consists primarily of nitric oxide (NO) and NO_2, plus small amounts of other compounds. Combustion sources produce NO_x by the following three mechanisms:

1. Thermal NOx is produced by the thermal dissociation and subsequent reaction of nitrogen and oxygen (O_2) molecules in the combustion air;
2. Fuel NOx is produced by the reaction of fuel-bound nitrogen compounds with O_2 molecules in the combustion air; and,
3. Prompt NO_x is produced by the formation of hydrogen cyanide (HCN) via the reaction of nitrogen radicals and hydrocarbons (HC), followed by the oxidation of HCN to NO.

NO_2 is produced by the oxidation of NO by O_2. This oxidation reaction is favored by a high O_2 concentration. Since the reaction is exothermic, NO_2 formation is also favored by low temperature. Hence, rapid cooling of combustion products in the presence of a high O_2 concentration will promote conversion of NO to NO_2. Essentially all of the NO_x formed by distillate oil combustion sources is thermal NO_x because this fuel has little or no chemically bound fuel nitrogen. NO_x from fuel combustion typically consists of 90 to 95 percent NO. The balance is primarily NO_2.

The USEPA NO_2/NO_x In-Stack Ratio (ISR) Database[30] was reviewed to determine representative NO_2/NO_x ratios for diesel engines. The USEPA ISR database includes NO_2/NO_x ratios that range from 0.02 to 0.09 for diesel engines that are representative of the envelope of vessels for Project construction/O&M that were modeled for the Project. The envelope of diesel engines do not include any units with advanced add-on emission controls, such as selective catalytic reduction. Therefore, in reviewing USEPA's ISR database, the uncontrolled engine data were considered. Thus, based upon the maximum NO_2/NO_x ratio provided in the USEPA data, a conservative in-stack NO_2/NOx ratio of 0.10 for the diesel engines was used in the 1-hour NO_2 modeling analysis.

5.3.2 1-hour NO_2 Background Concentrations

Pollutant background concentrations are required to appropriately assess the ambient air quality concentrations that may contribute to the total ambient pollutant concentrations. Background concentrations are added to model-predicted concentrations to calculate the total concentrations for comparison to the NAAQS. Criteria pollutant background concentration values are derived from ambient air quality data monitored at stations that are determined to be representative of expected background concentrations at the proposed source location and potential impact area. In order to conduct NAAQS assessments, background values must be combined with modeled results to compare to the 1-hour NO_2 NAAQS.

Based on review of the locations of Maryland, Delaware, and New Jersey ambient air quality monitoring sites, the closest "regional" monitoring site was used to represent the current

30 https://www.epa.gov/scram/nitrogen-dioxidenitrogen-oxide-stack-ratio-isr-database

background NO_2 air quality in the site area. Background data for NO_2 from 2019-2021 was obtained from a monitoring station located in Millville, New Jersey (EPA AIRData # 34-011-0007).

The March 1, 2011 Fox memorandum "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO_2 NAAQS (USEPA, March 1, 2011) provides guidance for incorporating background concentrations in the impact assessment for the 1-hour NO_2 standard.

"We believe that an appropriate methodology for incorporating background concentrations in the cumulative impact assessment for the 1-hour NO_2 standard would be to use multiyear average of the 98th-percentile of the available background concentrations by season and hour-of-day…"

"…we recommend that background values by season and hour-of-day used in the context should be based on the 3rd highest values for each season and hour of day combination…"

This seasonal and hour of day methodology is proposed was used. The background values were first divided by season for each year. Those seasonal groups were further binned into 24-hour groups for a total of 96 bins of values (product of 4 seasons and 24 hours) for each year (2019, 2020, and 2021). The 3rd highest value from each bin was found per year. Finally, to obtain the values to be summed with the modeled concentrations, the average of those 3rd highest values was taken over three (3) years. This results in 96 values that were used in the modeling analysis. The AERMOD model option (keyword BACKGROUND) was used to sum each modeled concentration with the background concentration that was calculated for that season and hour-of-day.

5.3.3 Hourly Average Background Ozone Concentrations

Based on review of the locations of ambient air quality monitoring sites, the closest "regional" monitoring site was used to represent the current background ozone air quality in the site area. Representative hourly average background ozone concentrations were input to AERMOD. The ozone monitor closest to the proposed Project site was identified. After reviewing monitoring locations and periods of record, a monitor in Lewes, Delaware (USEPA AIRData # 10-005-1003) was used to represent the ozone background values during the three (3) year period 2019–2021, concurrent with the three (3) years of surface meteorological data. When ozone data is missing from the Lewes monitor, missing hours were substituted using data from 2nd nearest monitoring station, located in Seaford, Delaware (10-005-1002).

5.4 Ozone and PM2.5 – Secondary Formation

Although the Project centroid is not in or close to non-attainment areas for ozone or PM2.5, an analysis was performed to evaluate whether the emissions from the Project will impact the non-attainment areas (emissions from the non-attainment area [port activities] will need to be offset). USEPA has recently finalized its Guidance for Ozone and Fine Particulate Matter Permit Modeling (June 29, 2022). This Guidance relies upon the Tier 1 Demonstration for Modeled Emission Rates for Precursors of Ozone and PM2.5 (MERPS). A MERPS analysis was performed to determine if enough annual emissions will cause an impact in the non-attainment areas.

Additionally, USEPA has recently (November 2022) issued "Photochemical Model Estimated Relationships Between Offshore Wind Energy Project Precursor Emissions and Downwind Air Quality (O_3 and PM2.5) Impacts", USEPA-454/R-22-007. This document provides the results of photochemical model analysis for the area near the Project, at the location of the project centroid (i.e., Source #5 referenced in the document). Because the activities of this wind energy application are close to shore, it is not expected that high concentrations of chemically produced ozone or particles will occur at the near shore. The transfer coefficients for Source #5 and the potential Project air emissions were used to calculate the secondary formation of PM2.5 for inclusion into modeling assessment for comparison to SILs, increments, and the NAAQS. The detailed summary of the maximum secondary formation for PM2.5 and ozone are provided in Table 5-2.

5.5 Project OCS Sources and Modeled Emission Units

All emission units considered OCS sources and all potential emissions associated with the OCS source(s) were included in the modeling. See Section 2.0 for a detailed explanation of the Project OCS source(s) and potential emissions. The vessel list and associated information for each vessel is presented in Appendix A. Additionally, a description of the modeled emission source names (i.e., AERMOD Source IDs) is provided in Appendix A, Tables A-2 through A-15.

5.5.1 OCS Sources

A number of vessels would be required to support activities carried out during the construction and O&M phases of the Project. Specific vessels are required for surveying activities, foundation installation, OSS installation, cable installation, WTG installation, and support activities. The vessels would vary in size and complexity based on their function on the Project. The vessels employed on the Project will be required to comply with applicable USCG and Jones Act regulations for conducting operations in U.S. waters. All foreign flag vessels employed on the Project will, in addition to meeting applicable USCG and Jones Act requirements, be required to meet International Maritime Organization (IMO) and International Marine Contractors Association (IMCA) requirements. The specific vessels selected to perform the required tasks during construction will be dependent upon availability at the commencement of each activity. US Wind will secure vessel supply in advance to prevent any delays to the construction schedule.

Because construction activity is expected to occur over a 3 to 4 year period, and numerous individual vessel activities would occur over this time period, the short-term (i.e., 1-hour, 3-hour, 8-hour, and 24-hour) and annual construction activities that result in maximum air emissions are modeled for comparison to NAAQS and PSD increments. With this modeling methodology, any combination of construction activities that would result in lower emissions would have less of an air quality impact than from the maximum emissions scenarios.

The proposed peak year of construction and commissioning, corresponding to the maximum annual potential to emit subject, captures all of the activities that could potentially occur within the 25 NM OCS area and as such, was included in the annual modeling analyses. For the peak year of construction, commissioning (including any overlapping O&M), the following activities may be taking place in various areas of the WDA simultaneously:

- Monopile (MP) Foundation Installation;
- Scour protection installation;
- WTG Installation;
- WTG Commissioning;
- OSS Installation;
- OSS Commissioning;
- Inter-Array Cable Installation;
- Offshore Export Cable Installation; and
- Overlapping O&M activities.

O&M phase emissions would consist of the following activities:

- Vessel transit within the OCS area;
- Onsite maneuvering at the WTGs and OSSs; and
- Onsite diesel generators.

Activities would occur throughout the 25 NM OCS area and will be transient. For example, the monopile foundation installation would occur over the course of two days for a specific WTG location. Then, the group of ships responsible for the monopile installation would move to the next WTG position and begin installation of another monopile. For simplification of the modeling given this spatial and temporal uncertainty regarding vessel locations, the modeling was conducted based on the assumption that these activities occur at the same location for the entire modeled period. Thus, all of the emission sources were modeled at one single location with the same coordinates. However, when this conservative assumption resulted in overly conservative modeling results, each vessel during transit was modeled as a line source, consisting of a series of point sources.

5.5.2 Exhaust Stack Configuration and Emission Parameters

As described elsewhere in this application, vessel and equipment specifications will change during development and construction of the Project. Vessel availability at the time of construction or O&M cannot be foreseen with any certainty, given the rapidly changing nature of the offshore wind industry and limitations on vessel use associated with the Jones Act. Vessel data will remain highly speculative throughout the permitting of the Projects. Vessel selection will not be refined until much closer to the start of construction, and vessels may be changed out even after construction begins. Therefore, modeling uses currently best-available information on representative vessel types, with typical or fleet- average emission rates. Overall, the use of the maximum design scenario associated with the Projects' PDE serves to ensure a reasonably conservative estimate of emission rates and impacts from the Project.

US Wind has provided estimates of source parameters (exit velocity, stack diameter, stack exit temperature) in Appendix A, Tables A-42 through A-44 for the types of ships that may be used for the construction and O&M activities. Appendix A also lists the individual vessel and equipment types associated with each of the activity types that were modeled. This general modeling conservatism is consistent with the PDE concept and allows for a demonstration of compliance with the applicable NAAQS standards and PSD Increments.

Consistent with the methodology in the Air Quality Modeling Protocol for averaging periods longer than 1-hour, the maximum source operation time for any given mode of operation and construction or O&M activity was modeled using the maximum hourly emissions rate that is scaled by the number of hours that source could be in operation by the number of hours in the averaging period. Tables A-42 through to A-44 provide detailed emissions for each pollutant and averaging period and a sample calculation is provided in Table A-42. US Wind notes that a propulsion or auxiliary engine can only be in one mode of operation at a time. For example, for a 24-hour PM averaging modeling demonstration, it would be inappropriate and would not occur in practice for an engine to be operating for 24-hours in both transiting mode and in maneuvering mode. The emissions were required to be scaled to take into consideration the actual amount of time that an engine can be operated in either a transit or maneuvering mode over the course of the averaging period.

5.5.3 Short-Term Averaging Periods

Nearly all construction, commissioning, and O&M activities will take place for only a few hours or days at any one WTG or OSS position, and most emissions sources will be in-motion. Generally, groups of vessels will work together to perform discrete activities such as WTG installation, scour protection, etc. As such, there is a temporally and spatially varying aspect to be considered. Techniques to address this variability depend on the applicable standard, pollutant, and averaging time. US Wind notes that the peak impacts will be entirely over water miles from shore, where there cannot possibly be any residences, and where the public is extremely unlikely to remain for any extended period.

5.5.3.1 Spatial Variability

As an initial conservative approach for modeling against short-term standards, all vessel transit emissions were modeled at a single location. This initial approach to transit emission is overly conservative, because impacts from vessel at any one location will last for a few seconds to minutes and will not impact short-term concentrations. The transiting vessels are traveling at a (relatively) high speed in a straight line over a long distance from one location to another. Additionally, maneuvering vessels were modeled at a single point, collocated with the transit emissions, as in initial conservative approach. The maneuvering vessels are moving at relatively low speed in one general area and are not anticipated to be stationary or otherwise moored or anchored. Because transit emissions will only occur at any one location for a few seconds, those emissions would not reasonably contribute to 1-hour, 3-hour, 8-hour, or 24-hour average ambient concentrations at any one location. However, as an initial conservative approach given the temporal and spatial uncertainly of transit and maneuvering emissions, all of the emissions were assumed from a single point. Furthermore, the maximum of either the transiting emissions or maneuvering emissions was modeled for comparison to the 1-hour averaging periods. This assumption results in a conservative analysis of groups of vessels that may either be transiting or maneuvering in any single hour.

When the initial conservative approach to transit emissions resulted in overly conservative modeling results, US Wind modeled the transit emissions as a series of point sources (i.e., 1-hour NO_2, 24-hour PM) as discussed within the Air Quality Modeling Protocol (Appendix B-3). Additionally, for 1-hour NO_2 modeling, the construction and O&M scenario vessels were modeled with both vessel operational modes and the maximum impact from either vessel operational scenario (i.e., transiting or maneuvering) was then selected as the worst-case emissions scenario.

The AERMOD model allows for modeling multiple line source at a time, and the averaging period may be 1-hour to annual. Therefore, for any refined modeling of the transit emission, the transiting sources were modeled as a set of individual point sources along the length of the transit route. The total aggregate emissions of the individual point sources are the same as the total line source emissions calculated for the vessel activity. The point sources representing the line source are spaced approximately 0.6 mile (1 km) apart. This representation of the line sources will allow for consistent modeling of 1-hour, 3-hour, 8-hour, 24-hour, and annual averages. The line source geometry was developed by conservatively assuming that all transiting vessels would follow the exact same route from the Sparrows Point route starting at a point 25 NM from the Project Centroid until the vessel reaches the Project Centroid. This methodology is conservative as it assumes that all transiting vessel emissions occur simultaneously both temporally and spatially (i.e., they are overlapping point sources). The AERMOD model source IDs for vessel transiting emissions are provided in the air quality modeling files and use the same naming convention as provided in Table A-45.

Table 5-3 provides a summary of the refinements made to the 1-hour NO_2 and 24-hour PM modeling for the SILs, PSD increment, and NAAQS compliance demonstrations. Note that refined modeling was not necessary for CO, SO_2, annual NO_2, and annual PM2.5.

5.5.3.2 Temporal Variability

US Wind used the following approach for modeling short-term standards:

- Model each construction/O&M operation (i.e., including all the vessels and engines that would be in a single area at the same time), at a single location.
- Model as if the operation takes place at that single location for the entire modeling period (three years of meteorological data); and
- Separate modeling for individual construction/O&M scenarios. The conservatism associated with the single operating scenario occurring year-round at one spot renders modeling overlapping construction and O&M scenarios as unnecessary and overly conservative, as discussed further below.

The source operation resulting in the highest total impact at any receptor represents the worst-case impact. Each construction and O&M scenario was initially modeled with all vessels associated with a scenario. This is a conservative assumption provided that all of the vessels would not be expected to operate together within an hourly or daily period based on need, availability, logistics, and safety. Each scenario includes engines that would be in a single area at the same time. This conservative assumption resulted in overly conservative impacts for 1-hour NO_2 and 24-hour PM. As such, US Wind refined the modeling for these pollutants to only include those vessels and engines that would be expected to operate together over an hourly or daily basis. Appendix A provides information regarding the vessel operations, emission points, and exhaust parameters for each scenario. Table A-45 provides a detailed matrix of emission sources and operating scenarios for each modeled pollutant and averaging period. The modeled scenarios included the following activities: foundation installation, WTG installation, WTG commissioning, OSS installation, inter-array cable installation, export cable installation, and O&M. This matrix was based on US Wind's determination of the feasibility that a vessel may be in operation simultaneously with another vessel, while taking into consideration need, availability, logistics, and security. For example, multiple towing tugs during WTG installation would not be needed simultaneously as determined by US Wind's construction management team. Oftentimes, US Wind determined that a duplicate vessel type could be excluded from the modeling analysis for short-term averaging periods.

The likelihood that any two construction/O&M scenarios could overlap in space and time is negligible and would likely not occur in practice. Thus, the chances of overlapping plumes is small, and combined with the additional levels of conservatism described above represent a possibility of overlapping (i.e., cumulative) impacts that is exceedingly small. To support the statement that overlapping impacts are unlikely, US Wind provides the following:

1. The concentration gradient associated with individual source operations is limited and localized. The location of maximum modeled impacts for individual source operations are similar provided that sources have similar stack heights and exhaust parameters given that they are combustion sources (i.e., engines).
2. The entire construction operation covers hundreds of positions over 10,000s of acres, and will take more than 3 years year to complete. The construction/O&M scenarios with substantial emissions each take less than 2 to 3 days or less to complete. Unless specifically scheduled to occur near each other, the chances of operations with substantial emissions occurring in nearby positions is very low.
3. US Wind has no intention of scheduling major construction operations near each other. For safety and logistics reasons, US Wind would avoid having large groups of vessels operating near one another.
4. The chance of an O&M activity having overlapping impacts with a construction activity is minimal as construction activities would not be anticipated nearby to an operating wind turbine.
5. Construction activities will happen only once per location. For O&M, the vessel's position will not be the same visit to visit. Some inspections will not involve disembarking at the WTG or OSS; the vessel will instead slowly circumnavigate the WTG or OSS while crew visually inspect for damage or wear. When crew are disembarking from service vessels, the vessel will approach from different directions depending on the wind and ocean conditions. After transfer of crew, the vessel will then back away from the WTG or OSS and station nearby while the crew is working. The vessel would station itself at a different location each time depending on the wind and ocean conditions.
6. The timing and order of the O&M activities will not be in a set pattern, and the schedule will change regularly based on weather conditions. Each construction activity will happen for a single stretch of time, which for activities such as foundation installation is a few days or less. Construction activities at any one position will be scheduled based on the weather and based on shifting logistics for the entire construction effort.

5.6 Maximum Modeled Project Concentrations

Table 5-4 presents the maximum modeled air quality concentrations as calculated by AERMOD for the modeled construction and O&M scenarios discussed in Section 5.5. As shown in Table 5-4, the maximum concentrations for selected construction and O&M scenarios exceed the applicable SILs for 1-hour and annual NO_2, 24-hour PM10, and 24-hour and annual PM2.5.

Under longstanding USEPA guidance and interpretations, the SILs are used to determine if a source makes or could make a significant contribution to a predicted violation of a NAAQS or PSD increment. If a source is predicted to have maximum impacts that are below the SILs, then a cumulative (or "full") impact analysis that includes other facilities is not required, and the impacts of the project are considered to be *de minimis* or insignificant. By showing that maximum predicted Project impacts will be below the corresponding SILs for CO and SO_2, the Project is exempt from the requirement to conduct any additional analyses to demonstrate compliance with the NAAQS for these pollutants.

5.6.1 Area of Impact Determination

Under PSD regulations, an air quality dispersion modeling analysis is required to ensure that CO, PM10, PM2.5, SO_2, and NO_2 emissions from the proposed Project will be compliant with NAAQS and applicable PSD increments.

As shown in Table 5-4, concentrations of 24-hour PM10, 24-hour and annual PM2.5, and 1-hour and annual NO_2 have been determined to be significant. Therefore, they are the only pollutants/averaging periods determined to have an area of impact (AOI), thus requiring additional impact assessments.

The areas of impact for the aforementioned pollutants under normal operations are as follows:

- 24-hour PM10 AOI = 1,250 meters;
- Annual PM2.5 AOI = 1,500 meters.
- 24-hour PM2.5 AOI = 5,000 meters;
- Annual NO_2 AOI = 7,500 meters; and
- 1-hour NO_2 AOI = 50,000 meters.

The additional impact assessment required for these pollutants and averaging periods is a multiple source NAAQS and PSD Class II increment modeling assessment as detailed in Sections 5.8 and 5.9.

5.7 Class I Impacts

There is one (1) Class I area within 300 km of the Project: The Brigantine Wilderness area located in the Edwin B. Forsythe National Wildlife Refuge in New Jersey, approximately 126 kilometers north-northeast of the Project. The Federal Land Manager (FLM) for this Class I area was notified on June 16, 2023 (provided in Appendix B-4) to determine if assessments of impacts in the Class I area would be required.

Based on the spatial limitations of the AERMOD model, a PSD Class I increment analysis was conservatively performed at a distance of 50 km from the centroid of the OCS area. Air quality concentrations of NO_2, SO_2, and PM10/PM2.5 in the Brigantine Wilderness Area were determined using the AERMOD model. Class I screening receptors were developed first by placing a ring of receptors at 50 kilometers from the Facility site. Maximum concentrations were then compared to the PSD Class I SILs and increments as shown in Table 5-5.

The results of the modeling indicate that the maximum impacts are greater than the PSD Class I SILs for annual NO_2, 24-hour PM10, and 24-hour PM2.5. The maximum modeled impacts are lower than the PSD Class I increments for all pollutants and averaging periods. It should be noted that the modeling results are highly conservative since they reflect the concentrations at a distance of 50 kilometers from the Facility rather than the nearest Class I area that is actually at a distance of approximately 126 km.

5.8 NAAQS Analysis

Modeled concentrations are greater than the SILs for pollutants subject to PSD review. Thus, NAAQS analyses for those pollutants were performed. The first step of conducting the NAAQS analysis is to determine the pollutant specific area(s) of impact of the proposed Project. The area of impact corresponds to the distance at which the model calculated pollutant concentrations fall below the SILs. The area of impact results are provided in Section 5.6. The NAAQS analysis used the same refinements for 1-hour NO_2 and 24-hour PM that were used in the PSD SILs demonstration that is discussed in Sections 5.3 and 5.6. The NAAQS analysis is based on the modeling methodology provided in Section 5.2 and the source emissions discussed in Section 5.5. The second step is obtaining off-site major source inventories within the area of impact plus a distance ranging from 10 km to 20 km from the source.

Off-site major sources were not necessary to be included in a multisource cumulative NAAQS assessment for the following reasons. Per 40 CFR Part 51, Appendix W Section 8.3.3, specific modeling should be performed for sources in the vicinity of the proposed Project for emissions sources that are not adequately represented by ambient monitoring data. Based on a review of MDE and DNREC major source air permits within 50 km of the Project centroid, there are no major air emissions sources in the vicinity of the Project with emissions of NO_x or PM10/PM2.5. Given that the monitor sites selected for this analysis have greater concentrations of existing emissions sources in close proximity than do the receptors of maximum concentration for each NAAQS modeled pollutant, it was not necessary to add in any offsite (i.e., nearby) emissions sources into the analysis. Review of MDE and DNREC permitting records indicates that there are no large emissions sources in the Ocean City area that could potentially add to the modeled concentrations of project sources, and thus, impacts of existing emission sources should be adequately captured by the conservative background monitors used for this analysis.

The maximum modeled concentrations were then added to the representative background concentrations for comparison to the NAAQS. The background data used for this analysis are described in Section 5.1. For the PM2.5 impacts, the Project's direct PM2.5 emissions are modeled using the AERCOARE/AERMOD system and secondary impacts are accounted for using the methodology in Section 5.4. The PM2.5 direct and secondary impacts are combined with background concentrations for comparison to the PM2.5 NAAQS.

The results of the NAAQS modeling analysis for each construction and O&M scenario are presented in Table 5-6. As shown in Table 5-6, the Project impacts, plus background, do not exceed or threaten to exceed the NAAQS.

5.9 PSD Increment Analysis

5.9.1 Class II Increment

The Project is located in a PSD Class II area. As discussed in Section 5.8, the maximum modeled impacts for NO_2, PM10, and PM2.5 were determined to be above the SILs. Thus, an analysis of the need to model offsite major PSD sources permitted or modified after the PSD baseline dates was conducted. As detailed in Section 5.8, a review of the MDE and DNREC permitting databases indicates that there are no PSD increment consuming sources within 50 km of the Project. Thus, the PSD increment modeling did not include offsite (i.e., nearby) sources.

The PSD increment analysis used the same refinements for 24-hour PM that were used in the PSD SILs demonstration that is discussed in Sections 5.3 and 5.6. The PSD increment analysis is based on the modeling methodology provided in Section 5.2 and the source emissions discussed in Section 5.5. The results of the PSD Class II increment analysis provided in Table 5-7 demonstrate that the emissions from the Project would not cause or contribute to air pollution in violation of any of the applicable PSD II increments. Note that PSD Class II increments are not provided in Table 5-7 for 1-hour NO_2 as the USEPA has not prescribed a PSD increment for this pollutant and averaging period.

5.9.2 Class I Increment

There is one (1) Class I area within 300 km of the Project: the Brigantine Wilderness area located in the Edwin B. Forsythe National Wildlife Refuge in New Jersey, approximately 126 kilometers north of the Project. Based on the spatial limitations of the AERMOD model, a PSD Class I increment analysis was conservatively performed at a distance of 50 km from the centroid of the OCS area.

The results of the modeling provided in Table 5-5 indicate that the maximum impacts are greater than the PSD Class I SILs for annual NO_2, 24-hour PM10, and 24-hour PM2.5. Given the overly conservative modeling at a distance of 50 km based on the spatial limitations of AERMOD, it is likely that the maximum modeled impacts would be below the PSD Class I SILs for all pollutants and averaging periods at a distance of 126 km. Regardless of the overly conservative Class I modeling, US Wind reviewed the MDE and DNREC air permits within 50 km of the Project. It was determined that there are no offsite PSD increment consuming sources within 50 km of the Project that would be required to be modeled in a cumulative PSD Class I increment assessment. US Wind also assessed the need to include offsite major sources in the angular arc from the

Project to the Class I area by assessing the PSD increment consuming sources in New Jersey that are proximate to the Class I area.

Based on a review of the NJDEP Technical Manual 1002, , the New Jersey PSD baseline date for PM10 is November 17, 1988, the PSD baseline date for PM2.5 is April 16, 2014, and the PSD baseline date for NO_2 is February 8, 1988. A review of major source operating permits for facilities near the Brigantine Wildlife Refuge was conducted based on NJDEP permitting records. No nearby major sources have had emissions increases since the appropriate baseline date that are expected to consume Class I increment. Note that the NJDEP permitting review indicated that there is PSD increment expanding source nearby to the Class I area (the shutdown of the BL England coal-fired power plant). US Wind does not take credit for this expansion. This is because of anticipated difficulties in documenting the actual emissions reductions and stack parameters at the shuttered facility, and the difficulties in incorporating onshore and offshore emissions sources in the same modeling analysis. Thus, the PSD Class I modeling did not include any PSD increment consuming or expanding sources.

As shown in Table 5-8, the maximum modeled impacts are lower than the PSD Class I increments for all pollutants and averaging periods.

5.10 Additional Impact Analyses

In addition to assessing impacts on the NAAQS and PSD increments, facilities subject to PSD review must assess the potential impact for the area as a result of growth, and the potential impacts to soils, vegetation, and visibility in the area surrounding the proposed facility.

5.10.1 Assessment of Impacts Due to Growth

Elements of the growth analysis include: 1) a projection of the associated industrial, commercial, and residential growth that would occur due to the construction and operation of the source, and 2) an estimate of the air emissions generated by the associated growth. As discussed below, for PSD air permit application purposes, the Project is anticipated to cause limited associated growth. Project-related activities and infrastructure that could potentially result in direct or indirect impacts to population, economy, and employment resources were discussed in Section Volume II of the Project's Construction and Operations Plan (COP). The analysis found that the Project will support an estimated 18,717 job-years during the construction and commissioning phase and an estimated additional 3,702 job-years in the operations and maintenance phase.

The Project presents an opportunity for the region, and Maryland in particular, to benefit from the economic activity related to the creation of a new industry. US Wind is focused on building out a local supply chain to benefit the Project and the broader US offshore wind industry. US Wind believes that a diverse, well-compensated, and well-trained workforce delivers a higher-quality product and service, which is why US Wind is committed to creating full and equitable business opportunities for minority, women-owned, veteran-owned, and HUBZone businesses in the development of the Project.

Population impacts to the communities could result from the short-term influx of construction personnel. The total population change would equal the total number of non-local construction workers plus any family members that may accompany them. Based on populations within the study area, the temporary addition of the non-local workforce for the duration of construction would not result in a sizeable population change. The temporary increase in population would be distributed throughout the study area and would have no permanent impact on the population. Additionally, given the population in the study area, the number of workers needed for operation of the US Wind onshore and offshore facilities would not result in a sizeable population change.

Due to the number of new individuals expected to move into the area to support the Project and the significant level of existing commercial activity in the area, new commercial construction is not foreseen to be needed to support the Project's work force.

For reasons described above, no significant emissions from secondary growth are anticipated to occur during either the construction and commissioning phase or the operations and maintenance phase. Therefore, the air quality impacts of the modest residential, commercial, or industrial growth associated with the Project will be insignificant.

Finally, the use of wind to generate electricity results in a net reduction of regional air pollution over the life of the Project through displacement of electricity generated by power plants fueled with fossil fuels. Because the air emissions from the proposed facility will not result in excessive PSD increment consumption, increment is available for new industry desiring to locate in the area. Therefore, the proposed facility should have no effect on future industrial, commercial, or residential growth in the region.

5.10.2 Assessment of Impacts on Soils and Vegetation

A component of the PSD review includes an analysis to determine the potential air quality impacts on sensitive vegetation types that may be present in the vicinity of the proposed Project. The evaluation of potential impacts on vegetation was conducted in accordance with "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals" (USEPA, 1980). This assessment compares the maximum-modeled Project impacts plus background to pollutant-specific concentration levels. These pollutant-specific concentration levels are minimum pollutant concentration levels at which damage to the natural vegetation and predominant crops could occur. Therefore, if the maximum-modeled concentrations are less than the pollutant-specific concentration levels, then no damage to vegetation will be anticipated.

Screening concentrations used in this assessment represent the minimum ambient concentrations reported in the scientific literature for which adverse effects (e.g., visible damage or growth retardation) to plants have been reported. Of the pollutants emitted by the proposed facility that triggered PSD review, vegetative screening concentrations are available for CO and NO_2. Screening concentrations for particulate matter are not currently available. Most of the designated vegetation screening levels are equivalent to or exceed NAAQS and/or PSD increments, so that satisfaction of NAAQS and PSD increments assures compliance with sensitive vegetation screening levels.

Table 5-9 presents a comparison of maximum modeled concentrations from the Project (including ambient background levels) for the two constituent pollutants of concern (i.e., NO_2 and CO) with their respective vegetation screening concentrations. This table demonstrates that modeled concentrations are well below levels at which even sensitive vegetation would be affected.

The Project is located on open water, miles from the nearest land (and therefore the nearest vegetation). Therefore, the nearest vegetation with any commercial or recreational value is miles away, and there is no reasonable opportunity for emissions from the Project to have any impact on soils or vegetation. Further, the over-water modeling results show that vegetative screening thresholds shown in Table 5-9 could not be exceeded, even over water. Therefore, air emissions from the Projects will not negatively impact soils or vegetation.

5.10.3 Impact on Visibility

An assessment of the Project's potential impact on visibility from its emissions within the nearest surrounding area (i.e., Ocean City, MD) was performed using the USEPA VISCREEN model (version 13190). In order to assess the potential impact on regional visibility, the conservative Level–1 screening analysis using the VISCREEN model was conducted. The screening procedure involves calculation of three plume contrast coefficients using emissions of NO_2, PM/PM10, and sulfates (H_2SO_4). The Level-1 screening procedure determines the light scattering impacts of particulates, including sulfates and nitrates, with a mean diameter of two micrometers with a standard deviation of two micrometers. It was conducted assuming that all emitted particulate would be as PM10, which results in a conservative assessment of visibility impact. These coefficients consider plume/sky contrast, plume/terrain contrast, and sky/terrain contrast. The modeling was based on a 25 km visual background range indicated on Figure 9 – Regional Background Values, in the visibility assessment procedure described in the "Workbook for Plume Visual Impact Screening and Analysis" (USEPA, 1988).

A Level-1 screening analysis was performed for the maximum potential to emit emissions from either the construction and commissioning or O&M periods. The visibility assessment was performed for an observer at the scenic vista distance of 27 kilometers from the Project. A stable or "F" stability and the wind speed 1.0 meters per second were used. The results of the analysis are presented in Table 5-10, which indicate that Project will not impact visibility in the coastal communities in proximity to the Project.

5.10.4 Shoreline Fumigation

Coastal (i.e., shoreline) fumigation is a dispersion process during which a plume, released offshore in a stable or near stable layer, intersects with the unstable thermal internal boundary layer (TIBL) formed over land, is drawn into the TIBL towards the ground, and leads to higher ground level concentrations than in if the TIBL were not present. The TIBL is a convective boundary layer which forms over the land when the air temperature overland is warmer than the water surface temperature. The air circulation below the TIBL is unstable due to convective heating. As a plume enters the unstable circulation within the TIBL, fumigation occurs resulting in concentrations higher than otherwise would occur at the same location without the presence of shoreline fumigation conditions.

Over water, a low-level stable air mass (inversion) can form when the water surface is colder than the air above it. With an onshore flow, this stable air mass may be heated from below once it crosses the coastline. This heating happens most often during the daytime, particularly on sunny days when the denser, cooler from the over the water displaces the lighter, warmer air over land. Differences between the physical properties of land and water can lead to the development of an internal boundary layer formed below the higher atmospheric boundary layer near the shoreline. Above the TIBL the air mass is generally stable, whereas below the TIBL the air is unstable. Shoreline fumigation results when a plume is first emitted into the stable layer and transported with relatively little diffusion until the plume TIBL. Figure 5-1 provides a theoretical drawing of shoreline fumigation.

Coastal fumigation in the USEPA preferred model, OCD, is calculated by Turner (1970) using a complete vertical mixing assumption. Complete vertical mixing through the TIBL occurs as soon as the plume intercepts the TIBL. Note that both AERSCREEN (i.e., the screening version of AERMOD) and OCD calculates fumigation impacts based on the Turner (1970) procedures.

In order to trigger coastline fumigation in OCD, it is necessary to estimate the overwater stability class following a classification scheme similar to the Pasquill-Gifford-Turner stability (PG stability) in USEPA models. The Monin-Obukhov lengths (L) are used to estimate stability class. As discussed in the OCD Users Guide, the following Monin Obukhov lengths correspond to each PG stability classification:

- Stability Class B: $-10 \le L < 0$ meters
- Stability Class C: $-25 \le L < -10$ meters
- Stability Class D: $|L| > 25$ meters
- Stability Class E: $10 < L \le 25$ meters
- Stability Class F: $0 < L \le 10$ meters

Based on the OCD model formulation, fumigation will occur if the following conditions are met (assuming that flow is onshore):

- overwater stability class is E or greater; and
- overland stability class is A, B, or C.

Shoreline fumigation calculations in AERSCREEN and OCD are based on the calculations for inversion break-up fumigation described by Turner (1970). The model formula for calculating ground level air concentrations due to shoreline fumigation is calculated from:

$$X_f = Q \Big/ \left[(2\pi)^{0.5} u \left(\sigma_{ye} + {h_e}/{8}\right)(h_e + 2\sigma_{ze})\right]$$

Where: X_f = Concentration (g/m³)

Q = emission rate (g/s)

μ = stack top wind speed (2.5 m/s)

he = effective stack height

σ_z = vertical dispersion parameter incorporating buoyancy induced dispersion (m)

σ_y = horizontal dispersion parameter incorporating buoyancy induced dispersion (m)

If the meteorological conditions are met based on stability classification, then an approximation of the ground level concentrations due to shoreline fumigation can be calculated with the equation above.

In order to consider the impact of coastal (i.e., shoreline) fumigation, US Wind is providing an assessment of plume spread (i.e., σ_z and σ_y) using AERMOD debug options. The assessment evaluates impacts on an envelope of vessel sources to demonstrate that shoreline fumigation would not be of concern. US Wind utilized the AERMOD model debug options with the full set of AERCOARE meteorological data. This provides a conservative maximum estimate of potential shoreline fumigation as it assumes that all hours of the 3-year meteorological period would meet the shoreline fumigation stability and onshore flow criteria. US Wind conducted an assessment of the overwater stability using the AERCOARE meteorological data and determined that only 1.2% of the hours have stability classifications of E or F with onshore flow, where there is the potential for shoreline fumigation to occur if the overland stability class is A, B, or C. Thus, assuming that all modeled hours have potential for shoreline fumigation provides a very conservative estimate of the maximum ground level concentrations due to shoreline fumigation.

US wind prepared a fumigation assessment for an envelope of representative vessel operations because the Project will be constructed by numerous vessels with varying engine emissions and stack parameters. As such, US Wind selected frequently occurring small and large vessels used during the construction and operational phase. US Wind utilized the AERMOD debug options to obtain the horizontal and vertical dispersion parameters for each hour of the meteorological dataset. The horizontal and vertical dispersion coefficients are utilized with a normalized emission rate of 1.0 g/s to determine a normalized maximum concentration for each vessel due to shoreline fumigation. Note that the actual vessel stack heights were incorporated as the effective stack height to calculate fumigation concentrations. This is a conservative assumption as it assumes that there is nonexistent momentum and buoyancy plume rise at the plume exhaust point, which results in maximum ground level concentrations from shoreline fumigation.

US Wind prepared the modeling analyses at distances to the shoreline of 26.5 km and 500 meters for comparison purposes. The results of the fumigation calculations are provided in Table 5-11. The results indicate that the potential impacts from shoreline fumigation are nearly two orders of magnitude lower at the actual Project distance to shoreline when compared to a theoretical distance of 500 meters, where shoreline fumigation would lead to higher impacts than would otherwise occur. US Wind also compared the maximum normalized shoreline fumigation results to the maximum normalized results using the full receptor grid and assuming no shoreline fumigation. For all representative vessels, the maximum modeled concentrations are higher in the local area around the sources when compared to the maximum shoreline fumigation results.

Thus, with the Project's location well offshore and outside of the distance where shoreline fumigation is a concern, US Wind has determined that shoreline fumigation is not a concern for this Project and that the maximum modeled concentrations are well offshore and nearby to the WTGs, export cables, and OSSs.

5.11 Modeling Data Files

All modeling data files for the modeling analyses to determine the maximum ambient ground-level concentrations from the proposed facility are available upon request.

Table 5-1: Maximum Measured Ambient Air Quality Concentrations

Pollutant	Averaging Period	2019	2020	2021	Background	Location	NAAQS
		Concentration (μg/m³ unless noted)					
CO (ppm)	1-Hour	1.2	1.8	1.4	**1.8**	Wilmington	35
	8-Hour	1	1.3	0.9	**1.3**	Wilmington	9
NO_2	1-Hour	35	32	34	**33.67**	Millville	188
	Annual	6.31	6.33	6.3	**6.33**	Millville	100
PM10	24-Hour	20	20	44	**44.0**	Hampton	150
PM2.5	24-Hour	19	16	19	**18.00**	Millville	35
	Annual	7.8	8.3	7	**7.70**	Millville	12
SO_2	1-Hour	1	2	1	**1.33**	Lewes	196
	24-Hour	0.4	0.4	0.3	**0.4**	Lewes	365
O_3 (ppb)	8-Hour	58	60	61	**59.67**	Lewes	80

Notes:

1. High second-high short term (1-, 8-, and 24-hour) and maximum annual average concentrations presented for all pollutants other than PM2.5 and 1-hour SO_2 and NO_2.
2. Bold values represent the proposed background values for use in any necessary NAAQS analyses.

Table 5-2. Summary of Secondary Air Quality Impacts

Pollutant	Averaging Period	Ozone Formation Transfer Coefficient (ppb/tpy)		PM2.5 Formation Transfer Coefficient (ug/m³/tpy)				Maximum Secondary Impact[1] (ppb – ozone, ug/m3 – PM2.5)
		NO_X	VOC	SO_2	NO_X	NH_3	PM2.5	
Ozone	8-hour	2.58 E-04	8.91E-04	NA	NA	NA	NA	1.69E-01
PM2.5	24-hour	NA	NA	3.19E-05	2.65E-05	6.06E-03	8.37E-04	3.26E-02
	Annual	NA	NA	3.05E-06	3.69E-06	1.86E-03	9.49E-05	4.12E-03

[1]Based on maximum potential to emit during construction period.

Table 5-3. Summary of Refined Modeling Procedures

Pollutant and Averaging Period	Regulatory Modeling Demonstration	Refined Modeling Procedures
1-hour NO_2	NAAQS	• Transit emissions were modeled as a series of point sources. • Includes only vessels and engines that would be expected to operate together over an hourly or daily basis[1]. • For 1-hour NO_2 modeling, the construction and O&M scenario vessels were modeled with both vessel operational modes and the maximum impact from either vessel operational scenario (i.e., transiting or maneuvering) was then selected as the worst-case emissions scenario.
24-Hour PM2.5	NAAQS, PSD Increment	
24-Hour PM10	NAAQS, PSD Increment	

Notes:[1] Refer to Appendix A for details of vessel operational assumptions.

Table 5-4: Maximum Modeled Concentrations for Project Construction and O&M Scenarios for Comparison to PSD Class II SILs

Pollutant	Averaging Period	Recommended Significant Impact Levels for NAAQS Analyses	Scenario	Maximum Modeled SIL Concentration	Exceed SIL?
CO	1-Hour	2,000	Foundation Installation	490.3	NO
			WTG Installation	206.8	NO
			WTG Commissioning	142.7	NO
			OSS Installation	345.0	NO
			Interarray Cable Installation	158.2	NO
			Export Cable Installation	124.5	NO
			O&M	668.0	NO
	8-Hour	500	Foundation Installation	275.1	NO
			WTG Installation	115.6	NO
			WTG Commissioning	72.1	NO
			OSS Installation	165.6	NO
			Interarray Cable Installation	75.2	NO
			Export Cable Installation	52.8	NO
			O&M	289.2	NO
NO_2	1-Hour	7.52	Foundation Installation	179.0	YES
			WTG Installation	85.8	YES
			WTG Commissioning	97.1	YES
			OSS Installation	169.9	YES
			Interarray Cable Installation	107.3	YES
			Export Cable Installation	87.8	YES
			O&M	205.9	YES
	Annual	1	Annual Construction and O&M	6.0	YES
PM2.5	24-Hour	1.2	Foundation Installation	6.4	YES
			WTG Installation	7.2	YES
			WTG Commissioning	3.5	YES
			OSS Installation	7.1	YES
			Interarray Cable Installation	4.7	YES
			Export Cable Installation	3.7	YES
			O&M	5.0	YES
	Annual	0.2	Annual Construction and O&M	0.5	YES

Pollutant	Averaging Period	Recommended Significant Impact Levels for NAAQS Analyses	Scenario	Maximum Modeled SIL Concentration	Exceed SIL?
PM10	24-Hour	5	Foundation Installation	8.7	YES
			WTG Installation	9.6	YES
			WTG Commissioning	4.9	NO
			OSS Installation	9.2	YES
			Interarray Cable Installation	6.5	YES
			Export Cable Installation	4.6	NO
			O&M	7.1	YES
	Annual	1	Annual Construction and O&M	0.5	NO
SO_2	1-Hour	7.82	Foundation Installation	4.6	NO
			WTG Installation	2.9	NO
			WTG Commissioning	0.4	NO
			OSS Installation	3.3	NO
			Interarray Cable Installation	2.6	NO
			Export Cable Installation	3.3	NO
			O&M	3.4	NO
	3-Hour	25	Foundation Installation	2.5	NO
			WTG Installation	1.6	NO
			WTG Commissioning	0.2	NO
			OSS Installation	1.8	NO
			Interarray Cable Installation	1.5	NO
			Export Cable Installation	2.0	NO
			O&M	1.8	NO
	24-Hour	5	Foundation Installation	1.5	NO
			WTG Installation	1.4	NO
			WTG Commissioning	0.1	NO
			OSS Installation	0.6	NO
			Interarray Cable Installation	0.6	NO
			Export Cable Installation	0.8	NO
			O&M	1.2	NO
	Annual	1	Annual Construction and O&M	0.03	NO

Note: All concentration in units of ug/m^3.

Table 5-5: Maximum Modeled Concentrations for Project Construction and O&M Scenarios for Comparison to PSD Class I SILs

Pollutant	Averaging Period	Significant Impact Levels for Increment Analyses	Scenario	Maximum Modeled SIL Concentration	Exceed SIL?
NO_2	Annual	0.1	Annual Construction and O&M	0.1	YES
PM2.5	24-Hour	0.27	Foundation Installation	0.6	YES
			WTG Installation	0.3	YES
			WTG Commissioning	0.07	NO
			OSS Installation	0.5	YES
			Interarray Cable Installation	0.3	NO
			Export Cable Installation	0.3	YES
			O&M	0.3	NO
	Annual	0.05	Annual Construction and O&M	0.008	NO
PM10	24-Hour	0.3	Foundation Installation	0.6	YES
			WTG Installation	0.3	NO
			WTG Commissioning	0.04	NO
			OSS Installation	0.5	YES
			Interarray Cable Installation	0.2	NO
			Export Cable Installation	0.2	NO
			O&M	0.2	NO
	Annual	0.2	Annual Construction and O&M	0.004	NO
SO_2	3-Hour	1	Foundation Installation	0.24	NO
			WTG Installation	0.09	NO
			WTG Commissioning	0.01	NO
			OSS Installation	0.12	NO
			Interarray Cable Installation	0.13	NO
			Export Cable Installation	0.18	NO
			O&M	0.12	NO
	24-Hour	0.2	Foundation Installation	0.05	NO
			WTG Installation	0.02	NO
			WTG Commissioning	0.0008	NO
			OSS Installation	0.03	NO
			Interarray Cable Installation	0.03	NO
			Export Cable Installation	0.04	NO
			O&M	0.03	NO
	Annual	0.1	Annual Construction and O&M	0.0004	NO

Note: All concentration in units of ug/m^3.

Table 5-6: Maximum Modeled Concentrations for Project Construction and O&M Scenarios for Comparison to NAAQS

Pollutant	Averaging Period	Scenario	NAAQS	Background	Maximum Modeled NAAQS Concentration	Total NAAQS Concentration with Background
CO	1-Hour	Foundation Installation	40,000	2,070	490.3	2,560.3
		WTG Installation			206.8	2,276.8
		WTG Commissioning			142.7	2,212.7
		OSS Installation			345.0	2,415.0
		Interarray Cable Installation			158.2	2,228.2
		Export Cable Installation			124.5	2,194.5
		O&M			668.0	2,738.0
	8-Hour	Foundation Installation	10,000	1,495	275.1	1,770.1
		WTG Installation			115.6	1,610.6
		WTG Commissioning			72.1	1,567.1
		OSS Installation			165.6	1,660.6
		Interarray Cable Installation			75.2	1,570.2
		Export Cable Installation			52.8	1,547.8
		O&M			289.2	1,784.2
NO_2	1-Hour	Foundation Installation	188	Variable by Season and Hour of Day	106.9	145.0
		WTG Installation			50.8	92.3
		WTG Commissioning			64.6	84.3
		OSS Installation			88.2	126.3
		Interarray Cable Installation			70.3	113.1
		Export Cable Installation			37.0	85.7
		O&M			142.3	172.3
	Annual	Annual Construction and O&M	100	12	6.0	17.9
PM2.5	24-Hour	Foundation Installation	35	18	3.6	21.6
		WTG Installation			4.0	22.0
		WTG Commissioning			1.8	19.8
		OSS Installation			4.7	22.7
		Interarray Cable Installation			2.6	20.6
		Export Cable Installation			2.0	20.0
		O&M			2.9	20.9
	Annual	Annual Construction and O&M	12	8	0.5	8.2

Pollutant	Averaging Period	Scenario	NAAQS	Background	Maximum Modeled NAAQS Concentration	Total NAAQS Concentration with Background
PM10	24-Hour	Foundation Installation	150	44	8.7	52.7
		WTG Installation			9.6	53.6
		WTG Commissioning			4.9	48.9
		OSS Installation			9.2	53.2
		Interarray Cable Installation			6.5	50.5
		Export Cable Installation			4.6	48.6
		O&M			7.1	51.1
	Annual	Annual Construction and O&M	NA	NA	0.5	NA
SO_2	1-Hour	Foundation Installation	196	3	4.3	7.8
		WTG Installation			2.8	6.3
		WTG Commissioning			0.3	3.8
		OSS Installation			3.1	6.6
		Interarray Cable Installation			2.2	5.7
		Export Cable Installation			2.0	5.5
		O&M			3.0	6.5
	3-Hour	Foundation Installation	1,300	3	2.5	6.0
		WTG Installation			1.6	5.1
		WTG Commissioning			0.2	3.7
		OSS Installation			1.8	5.3
		Interarray Cable Installation			1.5	5.0
		Export Cable Installation			2.0	5.5
		O&M			1.8	5.3
	24-Hour	Foundation Installation	365	1	1.5	2.5
		WTG Installation			1.4	2.5
		WTG Commissioning			0.1	1.1
		OSS Installation			0.6	1.7
		Interarray Cable Installation			0.6	1.6
		Export Cable Installation			0.8	1.8
		O&M			1.2	2.3
	Annual	Annual Construction and O&M	80	1	0.03	1.1

Note: All concentration in units of ug/m^3.

Table 5-7: Maximum Modeled Concentrations for Project Construction and O&M Scenarios for Comparison to PSD Class II Increments

Pollutant	Averaging Period	Scenario	Class II Increment	Maximum Modeled Increment Concentration	Exceed Increment?
NO_2	Annual	Annual Construction and O&M	25	6.0	NO
PM2.5	24-Hour	Foundation Installation	9	6.2	NO
		WTG Installation		6.9	NO
		WTG Commissioning		3.4	NO
		OSS Installation		8.2	NO
		Interarray Cable Installation		4.6	NO
		Export Cable Installation		4.0	NO
		O&M		5.6	NO
	Annual	Annual Construction and O&M	4	0.5	NO
PM10	24-Hour	Foundation Installation	30	6.4	NO
		WTG Installation		7.1	NO
		WTG Commissioning		3.5	NO
		OSS Installation		8.4	NO
		Interarray Cable Installation		4.8	NO
		Export Cable Installation		4.0	NO
		O&M		5.7	NO
	Annual	Annual Construction and O&M	17	0.5	NO
SO_2	3-Hour	Foundation Installation	512	2.5	NO
		WTG Installation		1.6	NO
		WTG Commissioning		0.2	NO
		OSS Installation		1.4	NO
		Interarray Cable Installation		1.2	NO
		Export Cable Installation		1.6	NO
		O&M		1.6	NO
	24-Hour	Foundation Installation	91	1.0	NO
		WTG Installation		1.0	NO
		WTG Commissioning		0.1	NO
		OSS Installation		0.5	NO
		Interarray Cable Installation		0.5	NO
		Export Cable Installation		0.7	NO
		O&M		0.9	NO
	Annual	Annual Construction and O&M	20	0.03	NO

Note: All concentration in units of ug/m^3.

Table 5-8: Maximum Modeled Concentrations for Project Construction and O&M Scenarios for Comparison to PSD Class I Increments

Pollutant	Averaging Period	Scenario	Class I Increment	Maximum Modeled Increment Concentration	Exceed Increment
NO_2	Annual	Annual Construction and O&M	2.5	0.1	NO
PM2.5	24-Hour	Foundation Installation	2	0.2	NO
		WTG Installation		0.1	NO
		WTG Commissioning		0.05	NO
		OSS Installation		0.2	NO
		Interarray Cable Installation		0.1	NO
		Export Cable Installation		0.2	NO
		O&M		0.1	NO
	Annual	Annual Construction and O&M	1	0.008	NO
PM10	24-Hour	Foundation Installation	8	0.2	NO
		WTG Installation		0.1	NO
		WTG Commissioning		0.02	NO
		OSS Installation		0.2	NO
		Interarray Cable Installation		0.1	NO
		Export Cable Installation		0.1	NO
		O&M		0.1	NO
	Annual	Annual Construction and O&M	4	0.004	NO
SO_2	3-Hour	Foundation Installation	25	0.19	NO
		WTG Installation		0.07	NO
		WTG Commissioning		0.004	NO
		OSS Installation		0.09	NO
		Interarray Cable Installation		0.11	NO
		Export Cable Installation		0.15	NO
		O&M		0.10	NO
	24-Hour	Foundation Installation	5	0.02	NO
		WTG Installation		0.01	NO
		WTG Commissioning		0.0004	NO
		OSS Installation		0.01	NO
		Interarray Cable Installation		0.02	NO
		Export Cable Installation		0.02	NO
		O&M		0.01	NO
	Annual	Annual Construction and O&M	2	0.0004	NO

Note: All concentration in units of ug/m^3.

Table 5-9: Total Facility Comparison of Maximum Modeled Concentrations of Pollutants to Vegetation Screening Concentrations

Pollutant	Averaging Period	Maximum Modeled Concentration (µg/m3)	Background Concentration (µg/m3)	Total Concentration[a] (µg/m3)	Vegetation Screening Concentrations[f] (µg/m3)		
					Sensitive	Intermediate	Resistant
NO_2	4-Hour 8-Hour Annual	205.9[b,g] 205.9[b,g] 6.0[g]	63.3[c] 63.3[c] 11.9	269.2 269.2 17.9	3,760 3,760 -	9,400 7,520 94	16,920 15,040 -
CO	1-Week	289.2[e]	1,495[d]	1,784.2	1,800,000	-	18,000,000

[a]Total concentration = maximum modeled facility concentration + background concentration.
[b]Maximum modeled concentration conservatively based on 1-hour averaging period.
[c]Maximum background concentration conservatively based on 1-hour averaging period.
[d]Maximum background concentration conservatively based on 8-hour averaging period.
[e]Maximum modeled concentration conservatively based on 8-hour averaging period.
[f]Screening concentrations found in Table 3.1 of "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals" (EPA, 1980).
gIncludes use of PVMRM.
(-) No screening concentration available.

Table 5-10: VISCREEN Analysis Results

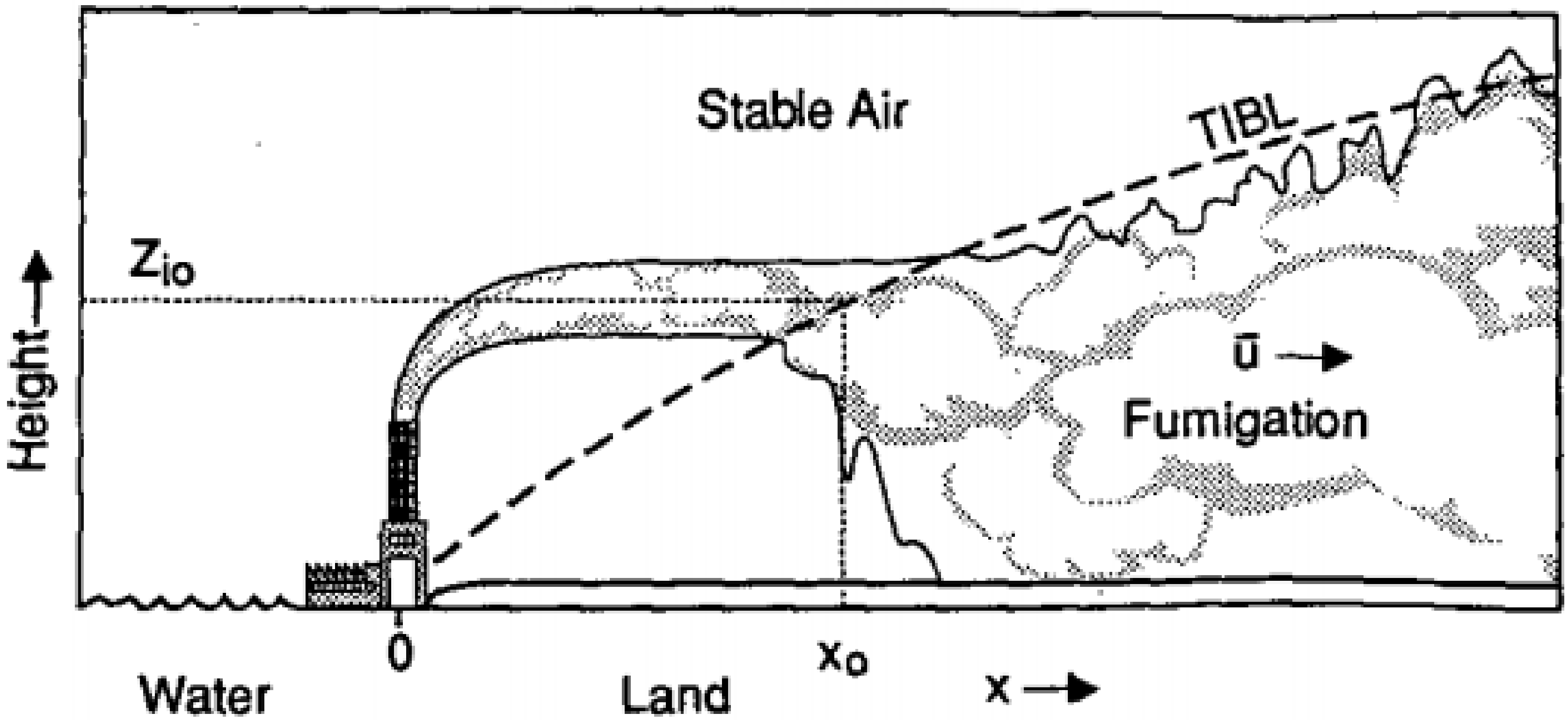
Background	Theta (degrees)	Azimuth (degrees)	Distance (km)	Alpha (degrees)	Delta E[a]		Contrast[b]	
					Criteria	Plume	Criteria	Plume
Inside Surrounding Area								
Sky	10	84	27	84	2	1.719	0.05	-0.005
Sky	140	84	27	84	2	0.564	0.05	-0.007
Terrain	10	84	27	84	2	0.358	0.05	0.003
Terrain	140	84	27	84	2	0.120	0.05	0.002
Outside Surrounding Area								
Sky	10	65	25.2	104	2	1.746	0.05	-0.005
Sky	140	65	25.2	104	2	0.572	0.05	-0.007
Terrain	10	50	23.6	119	2	0.445	0.05	0.003
Terrain	140	50	23.6	119	2	0.149	0.05	0.003

[a]Color difference parameter (dimensionless).
[b]Visual contrast against background parameter (dimensionless).

Table 5-11. Summary of Maximum Modeled 1-hour Shoreline Fumigation Impacts

Vessel	Engine Type	Shoreline Fumigation - Maximum Modeled Normalized Concentration (ug/m³ per g/s emitted)		No Shoreline Fumigation - Maximum Modeled Normalized Concentration (ug/m³ per g/s emitted)
		Receptor located at Shoreline	Receptor located 500 meters from Source	
Heavy Lift Vessel	Main	4.9	149.8	11.1
Transport Tug	Main	7.9	523.9	80.4
Operations CTV	Main	7.3	745.0	9.9
Trenching Vessel	Auxiliary	4.1	114.7	176.0

Figure 5-1: Coastal Fumigation



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Appendix A
Detailed Emission Calculations and Modeling Parameters

Table A-1
US Wind
Maryland Offshore Wind Project
Annual Air Emissions - Construction and Operation

Year	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	H_2SO_4	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)	CO2e (ton/year)	WTGs Constructed	WTGs Operational
Construction Year 1	248.95	4.48	60.44	8.10	7.85	0.79	0.001	0.53	0.04	16,517.0	0.12	0.78	16,751.1	21	0
Operation Year 1	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.0	0.00	0.00	0.0		
Year 1 Total	**248.95**	**4.48**	**60.44**	**8.10**	**7.85**	**0.79**	**0.001**	**0.53**	**0.04**	**16,517.0**	**0.12**	**0.78**	**16,751.1**		
Construction Year 2	611.23	10.93	145.26	19.93	19.32	1.99	0.003	1.29	0.09	39,925.7	0.26	1.90	40,499.4	55	21
Operation Year 2	4.35	0.33	4.23	0.11	0.11	0.01	0.0001	0.03	0.001	1,158.1	0.01	0.05	1,173.8		
Year 2 Total	**615.58**	**11.25**	**149.48**	**20.04**	**19.43**	**2.00**	**0.003**	**1.33**	**0.09**	**41,083.8**	**0.27**	**1.95**	**41,673.3**		
Construction Year 3	500.15	8.96	119.27	16.31	15.81	1.63	0.002	1.06	0.07	32,755.4	0.22	1.56	33,225.1	45	76
Operation Year 3	15.73	1.19	15.29	0.41	0.41	0.04	0.0003	0.12	0.002	4,191.1	0.04	0.19	4,248.1		
Year 3 Total	**515.88**	**10.15**	**134.56**	**16.72**	**16.22**	**1.68**	**0.003**	**1.18**	**0.08**	**36,946.5**	**0.26**	**1.75**	**37,473.2**		
Operation	**25.05**	**1.89**	**24.34**	**0.66**	**0.65**	**0.07**	**0.000**	**0.18**	**0.003**	**6,672.6**	**0.06**	**0.30**	**6,763.4**	0	121

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.

Table A-2
US Wind, Inc. - Maryland Offshore Wind Project
Foundation Installation - Short-Term Emissions

Vessel Information												Operation and Emission Factors																				
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Total Days Operating within WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	Operating Hours Year 1	Operating Hours Year 2	Operating Hours Year 3	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
OCS Air Permit Emissions During Construction																																
Scour Protection Installation																																
Scour protection installation vessel	Fallpipe vessel	FV1T1	Main Engine - In Transit		4,500	13,500	0.83	50	10	500	Sparrows Point	13.9		36		0	36	6	16	13	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		FV1M1	Main Engine - Maneuvering	3	4,500	13,500	0.2						93		24	2,232	2232	387	1015	830	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		FV1AT1	Auxiliary Engines - Transit		492	492	0.27	50	10	500		13.9		36		0	36	6	16	13	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	0.45						93		24	2,232	2232	387	1015	830	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Foundation Installation																																
Foundation installation vessel	Heavy lift vessel	FV2T1	Main Engine - In Transit		4,500	22,500	0.83	50	4	200	Rotterdam	14		14		0	14	2	6	5	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		FV2M1	Main Engine - Maneuvering		4,500	22,500	0.10						171		24	4,104	4104	712	1865	1526	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		FV2AT1	Auxiliary Engines - Transit		4500	4500	0.27	50	4	200		14		14		0	14	2	6	5	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV2AM1	Auxiliary Engines - Maneuvering	6	4500	4500	0.45						171		24	4,104	4104	712	1865	1526	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Tug for assisting foundation installation 1 -- Offshore	Tug	FV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	9	450	Sparrows Point	13.9		32		0	32	6	15	12	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						171		12	2,052	2052	356	933	763	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	9	450		13.9		32		0	32	6	15	12	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						171		12	2,052	2052	356	933	763	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Foundation transport tug 1	Tug	FV4T1	Main Engine - In Transit		2,540	5,080	0.83	50	21	1,050	Sparrows Point	13.9		76		0	76	13	34	28	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV4M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						32		18	567	567	98	258	211	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV4AT1	Auxiliary Engines - Transit		199	199	0.43	50	21	1,050		13.9		76		0	76	13	34	28	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV4AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						32		18	567	567	98	258	211	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Foundation transport tug 2	Tug	FV5T1	Main Engine - In Transit		2,540	5,080	0.83	50	20	1,000	Sparrows Point	13.9		72		0	72	12	33	27	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV5M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						30		18	540	540	94	245	201	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV5AT1	Auxiliary Engines - Transit		199	199	0.43	50	20	1,000		13.9		72		0	72	12	33	27	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						30		18	540	540	94	245	201	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Foundation transport tug 3	Tug	FV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	17	850	Sparrows Point	13.9		61		0	61	11	28	23	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						26		18	459	459	80	209	171	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		FV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	17	850		13.9		61		0	61	11	28	23	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						26		18	459	459	80	209	171	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Crew transfer vessel 1	Crew transfer vessel	FV7T1	Main Engine - In Transit		749	1,498	0.83	32.5	57	1,855	Ocean City	25		74		0	74	13	34	28	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV7M1	Main Engine - Maneuvering	2	749	1,498	0.2						57		10	570	570	99	259	212	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV7AT1	Auxiliary Engines - Transit		20	40	0.43	32.5	57	1,855		25		74		0	74	13	34	28	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						57		10	570	570	99	259	212	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Noise mitigation vessel	OSV	FV8T1	Main Engine - In Transit		3,310	6,620	0.83	50	9	450	Sparrows Point	10		45		0	45	8	20	17	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV8M1	Main Engine - Maneuvering	2	3,310	6,620	0.2						171		6	1,026	1026	178	466	382	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV8AT1	Auxiliary Engines - Transit		499	1497	0.27	50	9	450		10		45		0	45	8	20	17	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV8AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45						171		6	1,026	1026	178	466	382	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Acoustic monitoring - buoy support vessel	OSV	FV9T1	Main Engine - In Transit		2,540	5,080	0.83	50	8	400	Norfolk	13.9		29		0	29	5	13	11	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV9M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						171		6	1,026	1026	178	466	382	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV9AT1	Auxiliary Engines - Transit		199	199	0.56	50	8	400		13.9		29		0	29	5	13	11	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV9AM1	Auxiliary Engines - Maneuvering	1	199	199	0.56						171		6	1,026	1026	178	466	382	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Marine mammal observation 1	Crew transfer vessel	FV10T1	Main Engine - In Transit		749	1,498	0.83	32.5	114	3,710	Ocean City	10		371		0	371	64	169	138	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV10M1	Main Engine - Maneuvering	2	749	1,498	0.2						114		6	684	684	119	311	254	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV10AT1	Auxiliary Engines - Transit		20	40	0.43	32.5	114	3,710		10		371		0	371	64	169	138	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						114		6	684	684	119	311	254	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Environmental monitoring	Crew transfer vessel	FV11T1	Main Engine - In Transit		749	1,498	0.83	32.5	114	3,710	Ocean City	10		371		0	371	64	169	138	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV11M1	Main Engine - Maneuvering	2	749	1,498	0.2						114		6	684	684	119	311	254	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		FV11AT1	Auxiliary Engines - Transit		20	40	0.43	32.5	114	3,710		10		371		0	371	64	169	138	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		FV11AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						114		6	684	684	119	311	254	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-3
US Wind, Inc. - Maryland Offshore Wind Project
WTG Installation - Short-Term Emissions

Vessel Information												Operation and Emission Factors																				
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	Operating Hours Year 1	Operating Hours Year 2	Operating Hours Year 3	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
OCS Air Permit Emissions During Construction																																
WTG Installation																																
WTG installation jack-up vessel	Jack-up installation vessel	WV1T1	Main Engine - In Transit		3,800	11,400	0.83	50	5	250	Sparrows Point	12		21		0	21	4	9	8	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		WV1M1	Main Engine - Maneuvering	3	3,800	11,400	0						400		24	9,600	9600	1666	4364	3570	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		WV1AT1	Auxiliary Engines - Transit		2,880	2,880	0.27	50	5	250		12		21		0	21	4	9	8	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		WV1AM1	Auxiliary Engines - Maneuvering	1	2,880	2,880	0.45						400		24	9,600	9600	1666	4364	3570	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Tug to transport WTG 1	Tug	WV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	58	2,900	Sparrows Point	13.9		209		0	209	36	95	78	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		WV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						87		24	2,088	2088	362	949	777	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		WV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	58	2,900		13.9		209		0	209	36	95	78	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		WV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						87		24	2,088	2088	362	949	777	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Tug to transport WTG 2	Tug	WV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	56	2,800	Sparrows Point	13.9		201		0	201	35	92	75	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		WV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						84		24	2,016	2016	350	916	750	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		WV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	56	2,800		13.9		201		0	201	35	92	75	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		WV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						84		24	2,016	2016	350	916	750	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Tug to support WTG Installation / maneuvering offshore	Tug	WV4T1	Main Engine - In Transit		2,540	5,080	0.83	50	16	800	Sparrows Point	13.9		58		0	58	10	26	21	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		WV4M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						400		24	9,600	9600	1666	4364	3570	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		WV4AT1	Auxiliary Engines - Transit		199	199	0.43	50	16	800		13.9		58		0	58	10	26	21	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		WV4AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						400		24	9,600	9600	1666	4364	3570	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-4
US Wind, Inc. - Maryland Offshore Wind Project
WTG Commissioning - Short-Term Emissions

Vessel Information												Operation and Emission Factors																				
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	Operating Hours Year 1	Operating Hours Year 2	Operating Hours Year 3	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
OCS Air Permit Emissions During Construction																																
WTG Commissioning																																
Crew transfer vessel 1	Crew transfer vessel	CV1T1	Main Engine - In Transit		749	1,498	0.83	33	363	11,815		25		473		0	473	82	215	176	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		CV1M1	Main Engine - Maneuvering	2	749	1,498	0.2						373		12	4,476	4476	777	2035	1665	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		CV1AT1	Auxiliary Engines - Transit		20	40	0.43	33	363	11,815		25		473		0	473	82	215	176	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		CV1AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43				Ocean City		373		12	4,476	4476	777	2035	1665	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Crew transfer vessel 2	Crew transfer vessel	CV2T1	Main Engine - In Transit		749	1,498	0.83	33	359	11,685		25		467		0	467	81	212	174	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		CV2M1	Main Engine - Maneuvering	2	749	1,498	0.2						369		12	4,428	4428	768	2013	1647	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		CV2AT1	Auxiliary Engines - Transit		20	40	0.43	33	359	11,685		25		467		0	467	81	212	174	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		CV2AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43				Ocean City		369		12	4,428	4428	768	2013	1647	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Crew transfer vessel 3 per GE	Crew transfer vessel	CV3T1	Main Engine - In Transit		749	1,498	0.83	33	210	6,835		25		273		0	273	47	124	102	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		CV3M1	Main Engine - Maneuvering	2	749	1,498	0.2						220		12	2,640	2640	458	1200	982	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		CV3AT1	Auxiliary Engines - Transit		20	40	0.43	33	210	6,835		25		273		0	273	47	124	102	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		CV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43				Ocean City		220		12	2,640	2640	458	1200	982	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-5
US Wind, Inc. - Maryland Offshore Wind Project
OSS Installation - Short-Term Emissions

Vessel Information												Operation and Emission Factors																				
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	Operating Hours Year 1	Operating Hours Year 2	Operating Hours Year 3	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
OCS Air Permit Emissions During Construction																																
OSS Installation																																
OSS installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.83	50	4	200	Sparrows Point	14		14		0	14	2	6	5	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV1M1	Main Engine - Maneuvering		4,500	22,500	0.10						28		24	672	672	117	305	250	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.27	50	4	200		14		14		0	14	2	6	5	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	0.45						28		24	672	672	117	305	250	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Assisting tug for OSS Jacket and topside install	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	4	200	Sparrows Point	13.9		14		0	14	2	7	5	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						28		24	672	672	117	305	250	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	4	200		13.9		14		0	14	2	7	5	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						28		24	672	672	117	305	250	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
OSS Jacket and pilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	4	200	Sparrows Point	13.9		14		0	14	2	7	5	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						20		24	480	480	83	218	179	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV3AT1	Auxiliary Engines - Transit		199	199	0.56	50	4	200		13.9		14		0	14	2	7	5	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.56						20		24	480	480	83	218	179	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
OSS Jacket Install Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.83	50	4	200	Sparrows Point	13.9		14		0	14	2	7	5	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.2						8		12	96	96	17	44	36	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.27	50	4	200		13.9		14		0	14	2	7	5	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45						8		12	96	96	17	44	36	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,500	2,500	0.83	50	4	200	Sparrows Point	13.9		14		0	14	2	7	5	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV5M1	Main Engine - Maneuvering	1	2,500	2,500	0.2						8		12	96	96	17	44	36	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV5AT1	Auxiliary Engines - Transit		199	199	0.56	50	4	200		13.9		14		0	14	2	7	5	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.56						8		12	96	96	17	44	36	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
OSS Topside Transport (assume separate from Jacket/piles)	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	4	200	Sparrows Point	13.9		14		0	14	2	7	5	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						8		24	192	192	33	87	71	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	4	200		13.9		14		0	14	2	7	5	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						8		24	192	192	33	87	71	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Refueling operations to OSS and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.83	50	36	1,800	Norfolk	25		72		0	72	12	33	27	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV7M1	Main Engine - Maneuvering	2	749	1,498	0.2						72		24	1,728	1728	300	785	643	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV7AT1	Auxiliary Engines - Transit		20	40	0.56	50	36	1,800		25		72		0	72	12	33	27	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.56						72		24	1,728	1728	300	785	643	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.83	50	4	200	Sparrows Point	6		33		0	33	6	15	12	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.2						540		1	540	540	94	245	201	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	4	200		6		33		0	33	6	15	12	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43						540		1	540	540	94	245	201	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
OSS emergency generators	150 kW standard diesel generator	OD1	Engine	4	150	600	1.00	N/A	N/A	N/A	N/A	N/A	365	0	24	1000	8760	1000	1000	1000	T4	0.40	0.19	3.50	0.03	0.03	0.01	0.00	0.02	739.60	0.03	0.01

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-6
US Wind, Inc. - Maryland Offshore Wind Project
Inter-Array Cable Installation - Short-Term Emissions

Vessel Information												Operation and Emission Factors																				
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	Operating Hours Year 1	Operating Hours Year 2	Operating Hours Year 3	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
OCS Air Permit Emissions During Construction																																
Inter-Array Cable Installation																																
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	IV1T1	Main Engine - In Transit		1,750	5,250	0.83	50	12	600	Sparrows Point	14		43		0	43	7	19	16	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		IV1M1	Main Engine - Maneuvering		1,750	5,250	0.2						130		24	3,127	3127	543	1421	1163	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		IV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.56	50	12	600		14		43		0	43	7	19	16	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		IV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	0.56						130		24	3,127	3127	543	1421	1163	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Pre-lay grapnel run	Multipurpose offshore support vessel	IV2T1	Main Engine - In Transit		1611	1611	0.83	50	3	150	Sparrows Point	10		15		0	15	3	7	6	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		IV2M1	Main Engine - Maneuvering	1	1611	1611	0.2						23		12	274	274	47	124	102	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		IV2AT1	Auxiliary Engines - Transit		123	246	0.43	50	3	150		10		15		0	15	3	7	6	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		IV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.43						23		12	274	274	47	124	102	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Crew transfer vessel 1	Crew transfer vessel	IV3T1	Main Engine - In Transit		749	1,498	0.83	33	300	9,764	Ocean City	25		391		0	391	68	178	145	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		IV3M1	Main Engine - Maneuvering	2	749	1,498	0.2						300		12	3,600	3600	625	1636	1339	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		IV3AT1	Auxiliary Engines - Transit		20	40	0.43	33	300	9,764		25		391		0	391	68	178	145	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		IV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						300		12	3,600	3600	625	1636	1339	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Crew transfer vessel 2	Crew transfer vessel	IV4T1	Main Engine - In Transit		749	1,498	0.83	33	300	9,764	Ocean City	25		391		0	391	68	178	145	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		IV4M1	Main Engine - Maneuvering	2	749	1,498	0.2						300		12	3,600	3600	625	1636	1339	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		IV4AT1	Auxiliary Engines - Transit		20	40	0.43	33	300	9,764		25		391		0	391	68	178	145	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		IV4AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						300		12	3,600	3600	625	1636	1339	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Trenching vessel	Purpose-built offshore construction/ROV/survey vessel	IV5T1	Main Engine - In Transit		3,000	15,000	0.83	50	3	150	Sparrows Point	10		15		0	15	3	7	6	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		IV5M1	Main Engine - Maneuvering		3,000	15,000	0.2						130		24	3,120	3120	541	1418	1160	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		IV5AT1	Auxiliary Engines - Transit		3,000	3,000	0.27	50	3	150		10		15		0	15	3	7	6	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		IV5AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	0.45						130		24	3,120	3120	541	1418	1160	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Guard vessel	Crew transfer vessel	IV6T1	Main Engine - In Transit		749	1,498	0.83	33	10	325	Ocean City	13.5		24		0	24	4	11	9	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		IV6M1	Main Engine - Maneuvering	2	749	1,498	0.2						30		24	720	720	125	327	268	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		IV6AT1	Auxiliary Engines - Transit		20	40	0.43	33	10	325		13.5		24		0	24	4	11	9	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		IV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						30		24	720	720	125	327	268	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-7
US Wind, Inc. - Maryland Offshore Wind Project
Offshore Export Cable Installation - Short-Term Emissions

Vessel Information											
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project
OCS Air Permit Emissions During Construction											
Offshore Export Cable Installation											
Offshore export cable pre-lay survey, trenching, cable lay and pull	Cable lay vessel	ECV1T1	Main Engine - In Transit		1,750	5,250	0.83	50	4	200	Sparrows Point
		ECV1M1	Main Engine - Maneuvering		1,750	5,250	0.2				
		ECV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.56	50	4	200	
		ECV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	0.56				
Pre-lay grapnel run & pre-lay survey; post lay survey after completion	Multipurpose offshore support vessel	ECV2T1	Main Engine - In Transit		1,611	1,611	0.83	50	6	300	Sparrows Point
		ECV2M1	Main Engine - Maneuvering	1	1,611	1,611	0.2				
		ECV2AT1	Auxiliary Engines - Transit		123	246	0.43	50	6	300	
		ECV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.43				
Trenching vessel	Purpose built offshore construction/survey vessel	ECV3T1	Main Engine - In Transit		3,000	15,000	0.83	50	3	150	Sparrows Point
		ECV3M1	Main Engine - Maneuvering		3,000	15,000	0.2				
		ECV3AT1	Auxiliary Engines - Transit		3,000	3,000	0.27	50	3	150	
		ECV3AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	0.45				
HDD pull in lift vessel	Jack-up vessel	ECV4T1	Main Engine - In Transit		2,350	4,700	0.83	50	4	200	Leesburg, NJ
		ECV4M1	Main Engine - Maneuvering	2	2,350	4,700	0.00				
		ECV4AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	4	200	
		ECV4AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43				
Diving support for HDD pull in	Research / Survey	ECV5T1	Main Engine - In Transit		392	784	0.83	50	4	200	Leesburg, NJ
		ECV5M1	Main Engine - Maneuvering	2	392	784	0.2				
		ECV5AT1	Auxiliary Engines - Transit		135	270	0.43	50	4	200	
		ECV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43				
HDD pull in support vessel	Multipurpose offshore support vessel	ECV6T1	Main Engine - In Transit		1,611	1,611	0.83	50	56	2,800	Lewes, DE
		ECV6M1	Main Engine - Maneuvering	1	1,611	1,611	0.2				
		ECV6AT1	Auxiliary Engines - Transit		123	246	0.43	50	56	2,800	
		ECV6AM1	Auxiliary Engines - Maneuvering	2	123	246	0.43				

AERMOD ID	Operation and Emission Factors																				
AERMOD ID	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	Operating Hours Year 1	Operating Hours Year 2	Operating Hours Year 3	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
ECV1T1	14		14		0	14	2	6	5	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV1M1		120		24	2,880	2880	500	1309	1071	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV1AT1	14		14		0	14	2	6	5	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV1AM1		120		24	2,880	2880	500	1309	1071	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV2T1	10		30		0	30	5	14	11	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV2M1		40		24	960	960	167	436	357	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV2AT1	10		30		0	30	5	14	11	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV2AM1		40		24	960	960	167	436	357	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV3T1	10		15		0	15	3	7	6	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV3M1		120		24	2,880	2880	500	1309	1071	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV3AT1	10		15		0	15	3	7	6	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV3AM1		120		24	2,880	2880	500	1309	1071	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV4T1	6		33		0	33	6	15	12	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
ECV4M1		56		12	672	672	117	305	250	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
ECV4AT1	6		33		0	33	6	15	12	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV4AM1		56		12	672	672	117	305	250	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV5T1	15	0	13	0	0	13	2	6	5	8M	9.86	0.22	2.25	0.34	0.33	0.07	4.20E-05	0.03	638.26	0.004	0.03
ECV5M1		56		12	672	672	117	305	250	8M	9.86	0.22	2.25	0.34	0.33	0.07	4.20E-05	0.03	638.26	0.004	0.03
ECV5AT1	15	0	13	0	0	13	2	6	5	8A	10.21	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV5AM1		56		12	672	672	117	305	250	8A	10.21	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV6T1	15	0	187	0	0	187	32	85	69	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV6M1		56		12	672	672	117	305	250	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
ECV6AT1	15	0	187	0	0	187	32	85	69	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
ECV6AM1		56		12	672	672	117	305	250	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-8
US Wind, Inc. - Maryland Offshore Wind Project
Met Tower Installation - Short-Term Emissions

Vessel Information												Operation and Emission Factors																				
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	Operating Hours Year 1	Operating Hours Year 2	Operating Hours Year 3	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
Met Tower Installation Air Permit Emissions During Construction																																
Met Tower Installation																																
Met Tower installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.83	50	1	50	Sparrows	14		4		0	4	4	0	0	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV1M1	Main Engine - Maneuvering		4,500	22,500	0.00				Point		7		24	168	168	168	0	0	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.27	50	1	50		14		4		0	4	4	0	0	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	0.45						7		24	168	168	168	0	0	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Assisting tug	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows	13.9		4		0	4	4	0	0	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2				Point		7		24	168	168	168	0	0	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	4	0	0	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						7		24	168	168	168	0	0	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Met Tower PilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows	13.9		4		0	4	4	0	0	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2				Point		5		24	120	120	120	0	0	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	4	0	0	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						5		24	120	120	120	0	0	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.83	50	1	50	Sparrows	13.9		4		0	4	4	0	0	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.2				Point		2		12	24	24	24	0	0	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.27	50	1	50		13.9		4		0	4	4	0	0	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45						2		12	24	24	24	0	0	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,540	2,500	0.83	50	1	50	Sparrows	13.9		4		0	4	4	0	0	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV5M1	Main Engine - Maneuvering	2	2,540	2,500	0.2				Point		2		12	24	24	24	0	0	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV5AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	4	0	0	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						2		12	24	24	24	0	0	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Met Tower Topside Transport	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows	13.9		4		0	4	4	0	0	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2				Point		2		24	48	48	48	0	0	11M	9.52	0.18	2.29	0.33	0.32	0.03	4.50E-05	0.02	643.66	0.004	0.03
		OV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	4	0	0	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						2		24	48	48	48	0	0	11A	10.10	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Refueling operations to Met Tower and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.83	50	9	450	Norfolk	25		18		0	18	18	0	0	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV7M1	Main Engine - Maneuvering	2	749	1,498	0.2						18		24	432	432	432	0	0	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OV7AT1	Auxiliary Engines - Transit		20	40	0.43	50	9	450		25		18		0	18	18	0	0	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						18		24	432	432	432	0	0	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows	6		8		0	8	8	0	0	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.2				Point		135		1	135	135	135	0	0	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		6		8		0	8	8	0	0	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43						135		1	135	135	135	0	0	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-9
US Wind, Inc. - Maryland Offshore Wind Project
Foundation Installation - Short-Term Emissions

Vessel Information												Operation and Short-Term Emissions																
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Total Days Operating within WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
OCS Air Permit Emissions During Construction																												
Scour Protection Installation																												
Scour protection installation vessel	Fallpipe vessel	FV1T1	Main Engine - In Transit		4,500	13,500	0.83	50	10	500	Sparrows Point	13.9		36		0	36	234.43	6.18	54.35	8.40	8.15	2.10E+00	9.63E-04	6.67E-01	15686.51	9.88E-02	7.66E-01
		FV1M1	Main Engine - Maneuvering	3	4,500	13,500	0.2						93		24	2,232	2232	56.49	1.49	13.10	2.02	1.96	5.06E-01	2.32E-04	1.61E-01	3779.88	2.38E-02	1.85E-01
		FV1AT1	Auxiliary Engines - Transit		492	492	0.27	50	10	500		13.9		36		0	36	2.90	0.04	0.73	0.09	0.09	1.76E-03	1.41E-05	5.27E-03	189.83	1.17E-03	9.08E-03
		FV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	0.45						93		24	2,232	2232	11.77	0.17	2.95	0.38	0.37	7.14E-03	5.71E-05	2.14E-02	771.67	4.76E-03	3.69E-02
Foundation installation vessel	Heavy lift vessel	FV2T1	Main Engine - In Transit		4,500	22,500	0.83	50	4	200	Rotterdam	14		14		0	14	412.94	5.76	94.69	12.76	12.35	5.35E-01	1.85E-03	7.41E-01	26640.69	1.65E-01	1.28E+00
		FV2M1	Main Engine - Maneuvering		4,500	22,500	0.10						171		24	4,104	4104	49.75	0.69	11.41	1.54	1.49	6.45E-02	2.23E-04	8.93E-02	3209.72	1.98E-02	1.54E-01
		FV2AT1	Auxiliary Engines - Transit		4500	4500	0.27	50	4	200		14		14		0	14	30.94	0.38	6.64	0.86	0.83	1.61E-02	1.29E-04	4.82E-02	1736.25	1.07E-02	8.30E-02
		FV2AM1	Auxiliary Engines - Maneuvering	6	4500	4500	0.45						171		24	4,104	4104	51.56	0.63	11.07	1.43	1.38	2.68E-02	2.14E-04	8.04E-02	2893.75	1.79E-02	1.38E-01
Tug for assisting foundation installation 1 -- Offshore	Tug	FV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	9	450	Sparrows Point	13.9		32		0	32	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		FV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						171		12	2,052	2052	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		FV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	9	450		13.9		32		0	32	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		FV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						171		12	2,052	2052	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Foundation transport tug 1	Tug	FV4T1	Main Engine - In Transit		2,540	5,080	0.83	50	21	1,050	Sparrows Point	13.9		76		0	76	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		FV4M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						32		18	567	567	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		FV4AT1	Auxiliary Engines - Transit		199	199	0.43	50	21	1,050		13.9		76		0	76	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		FV4AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						32		18	567	567	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Foundation transport tug 2	Tug	FV5T1	Main Engine - In Transit		2,540	5,080	0.83	50	20	1,000	Sparrows Point	13.9		72		0	72	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		FV5M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						30		18	540	540	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		FV5AT1	Auxiliary Engines - Transit		199	199	0.43	50	20	1,000		13.9		72		0	72	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		FV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						30		18	540	540	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Foundation transport tug 3	Tug	FV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	17	850	Sparrows Point	13.9		61		0	61	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		FV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						26		18	459	459	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		FV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	17	850		13.9		61		0	61	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		FV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						26		18	459	459	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Crew transfer vessel 1	Crew transfer vessel	FV7T1	Main Engine - In Transit		749	1,498	0.83	32.5	57	1,855	Ocean City	25		74		0	74	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		FV7M1	Main Engine - Maneuvering	2	749	1,498	0.2						57		10	570	570	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		FV7AT1	Auxiliary Engines - Transit		20	40	0.43	32.5	57	1,855		25		74		0	74	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		FV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						57		10	570	570	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Noise mitigation vessel	OSV	FV8T1	Main Engine - In Transit		3,310	6,620	0.83	50	9	450	Sparrows Point	10		45		0	45	110.84	1.70	27.86	3.76	3.63	7.27E-02	5.57E-04	2.18E-01	7851.37	4.85E-02	3.76E-01
		FV8M1	Main Engine - Maneuvering	2	3,310	6,620	0.2						171		6	1,026	1026	26.71	0.41	6.71	0.90	0.88	1.75E-02	1.34E-04	5.25E-02	1891.90	1.17E-02	9.05E-02
		FV8AT1	Auxiliary Engines - Transit		499	1497	0.27	50	9	450		10		45		0	45	9.26	0.12	2.21	0.29	0.28	5.35E-03	4.28E-05	1.60E-02	577.59	3.56E-03	2.76E-02
		FV8AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45						171		6	1,026	1026	15.43	0.21	3.68	0.48	0.46	8.91E-03	7.13E-05	2.67E-02	962.65	5.94E-03	4.60E-02
Acoustic monitoring - buoy support vessel	OSV	FV9T1	Main Engine - In Transit		2,540	5,080	0.83	50	8	400	Norfolk	13.9		29		0	29	85.05	1.30	21.38	2.88	2.79	5.58E-02	4.28E-04	1.67E-01	6024.92	3.72E-02	2.88E-01
		FV9M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						171		6	1,026	1026	20.49	0.31	5.15	0.69	0.67	1.34E-02	1.03E-04	4.03E-02	1451.79	8.96E-03	6.94E-02
		FV9AT1	Auxiliary Engines - Transit		199	199	0.56	50	8	400		13.9		29		0	29	2.55	0.03	0.61	0.08	0.08	1.47E-03	1.18E-05	4.42E-03	159.25	9.83E-04	7.62E-03
		FV9AM1	Auxiliary Engines - Maneuvering	1	199	199	0.56						171		6	1,026	1026	2.55	0.03	0.61	0.08	0.08	1.47E-03	1.18E-05	4.42E-03	159.25	9.83E-04	7.62E-03
Marine mammal observation 1	Crew transfer vessel	FV10T1	Main Engine - In Transit		749	1,498	0.83	32.5	114	3,710	Ocean City	10		371		0	371	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		FV10M1	Main Engine - Maneuvering	2	749	1,498	0.2						114		6	684	684	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		FV10AT1	Auxiliary Engines - Transit		20	40	0.43	32.5	114	3,710		10		371		0	371	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		FV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						114		6	684	684	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Environmental monitoring	Crew transfer vessel	FV11T1	Main Engine - In Transit		749	1,498	0.83	32.5	114	3,710	Ocean City	10		371		0	371	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		FV11M1	Main Engine - Maneuvering	2	749	1,498	0.2						114		6	684	684	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		FV11AT1	Auxiliary Engines - Transit		20	40	0.43	32.5	114	3,710		10		371		0	371	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		FV11AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						114		6	684	684	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-10
US Wind, Inc. - Maryland Offshore Wind Project
WTG Installation - Short-Term Emissions

Vessel Information												Operation and Short-Term Emissions																
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
OCS Air Permit Emissions During Construction																												
WTG Installation																												
WTG installation jack-up vessel	Jack-up installation vessel	WV1T1	Main Engine - In Transit		3,800	11,400	0.83	50	5	250	Sparrows Point	12		21		0	21	209.22	2.92	47.98	6.47	6.26	2.71E-01	9.39E-04	3.75E-01	13497.95	8.34E-02	6.47E-01
		WV1M1	Main Engine - Maneuvering	3	3,800	11,400	0						400		24	9,600	9600	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		WV1AT1	Auxiliary Engines - Transit		2,880	2,880	0.27	50	5	250		12		21		0	21	19.80	0.24	4.25	0.55	0.53	1.03E-02	8.23E-05	3.09E-02	1111.20	6.86E-03	5.31E-02
		WV1AM1	Auxiliary Engines - Maneuvering	1	2,880	2,880	0.45						400		24	9,600	9600	33.00	0.40	7.09	0.91	0.89	1.71E-02	1.37E-04	5.14E-02	1852.00	1.14E-02	8.86E-02
Tug to transport WTG 1	Tug	WV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	58	2,900	Sparrows Point	13.9		209		0	209	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		WV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						87		24	2,088	2088	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		WV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	58	2,900		13.9		209		0	209	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		WV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						87		24	2,088	2088	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Tug to transport WTG 2	Tug	WV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	56	2,800	Sparrows Point	13.9		201		0	201	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		WV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						84		24	2,016	2016	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		WV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	56	2,800		13.9		201		0	201	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		WV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						84		24	2,016	2016	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Tug to support WTG Installation / maneuvering offshore	Tug	WV4T1	Main Engine - In Transit		2,540	5,080	0.83	50	16	800	Sparrows Point	13.9		58		0	58	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		WV4M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						400		24	9,600	9600	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		WV4AT1	Auxiliary Engines - Transit		199	199	0.43	50	16	800		13.9		58		0	58	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		WV4AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						400		24	9,600	9600	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-11
US Wind, Inc. - Maryland Offshore Wind Project
WTG Commissioning - Short-Term Emissions

Vessel Information											
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project
OCS Air Permit Emissions During Construction											
WTG Commissioning											
Crew transfer vessel 1	Crew transfer vessel	CV1T1	Main Engine - In Transit		749	1,498	0.83	33	363	11,815	
		CV1M1	Main Engine - Maneuvering	2	749	1,498	0.2				
		CV1AT1	Auxiliary Engines - Transit		20	40	0.43	33	363	11,815	
		CV1AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43				Ocean City
Crew transfer vessel 2	Crew transfer vessel	CV2T1	Main Engine - In Transit		749	1,498	0.83	33	359	11,685	
		CV2M1	Main Engine - Maneuvering	2	749	1,498	0.2				
		CV2AT1	Auxiliary Engines - Transit		20	40	0.43	33	359	11,685	
		CV2AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43				Ocean City
Crew transfer vessel 3 per GE	Crew transfer vessel	CV3T1	Main Engine - In Transit		749	1,498	0.83	33	210	6,835	
		CV3M1	Main Engine - Maneuvering	2	749	1,498	0.2				
		CV3AT1	Auxiliary Engines - Transit		20	40	0.43	33	210	6,835	
		CV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43				Ocean City

	Operation and Short-Term Emissions																
AERMOD ID	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
CV1T1	25		473		0	473	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
CV1M1		373		12	4,476	4476	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
CV1AT1	25		473		0	473	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
CV1AM1		373		12	4,476	4476	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
CV2T1	25		467		0	467	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
CV2M1		369		12	4,428	4428	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
CV2AT1	25		467		0	467	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
CV2AM1		369		12	4,428	4428	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
CV3T1	25		273		0	273	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
CV3M1		220		12	2,640	2640	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
CV3AT1	25		273		0	273	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
CV3AM1		220		12	2,640	2640	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-12
US Wind, Inc. - Maryland Offshore Wind Project
OSS Installation - Short-Term Emissions

Vessel Information												Operation and Short-Term Emissions																
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
OCS Air Permit Emissions During Construction																												
OSS Installation																												
OSS installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.83	50	4	200	Sparrows Point	14		14		0	14	412.94	5.76	94.69	12.76	12.35	5.35E-01	1.85E-03	7.41E-01	26640.69	1.65E-01	1.28E+00
		OV1M1	Main Engine - Maneuvering		4,500	22,500	0.10						28		24	672	672	49.75	0.69	11.41	1.54	1.49	6.45E-02	2.23E-04	8.93E-02	3209.72	1.98E-02	1.54E-01
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.27	50	4	200		14		14		0	14	30.94	0.38	6.64	0.86	0.83	1.61E-02	1.29E-04	4.82E-02	1736.25	1.07E-02	8.30E-02
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	0.45						28		24	672	672	51.56	0.63	11.07	1.43	1.38	2.68E-02	2.14E-04	8.04E-02	2893.75	1.79E-02	1.38E-01
Assisting tug for OSS Jacket and topside install	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	4	200	Sparrows Point	13.9		14		0	14	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						28		24	672	672	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		OV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	4	200		13.9		14		0	14	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						28		24	672	672	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
OSS Jacket and pilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	4	200	Sparrows Point	13.9		14		0	14	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						20		24	480	480	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		OV3AT1	Auxiliary Engines - Transit		199	199	0.56	50	4	200		13.9		14		0	14	2.48	0.03	0.61	0.08	0.08	1.47E-03	1.18E-05	4.42E-03	159.25	9.83E-04	7.62E-03
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.56						20		24	480	480	2.48	0.03	0.61	0.08	0.08	1.47E-03	1.18E-05	4.42E-03	159.25	9.83E-04	7.62E-03
OSS Jacket Install Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.83	50	4	200	Sparrows Point	13.9		14		0	14	110.84	1.70	27.86	3.76	3.63	7.27E-02	5.57E-04	2.18E-01	7851.37	4.85E-02	3.76E-01
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.2						8		12	96	96	26.71	0.41	6.71	0.90	0.88	1.75E-02	1.34E-04	5.25E-02	1891.90	1.17E-02	9.05E-02
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.27	50	4	200		13.9		14		0	14	9.26	0.12	2.21	0.29	0.28	5.35E-03	4.28E-05	1.60E-02	577.59	3.56E-03	2.76E-02
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45						8		12	96	96	15.43	0.21	3.68	0.48	0.46	8.91E-03	7.13E-05	2.67E-02	962.65	5.94E-03	4.60E-02
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,500	2,500	0.83	50	4	200	Sparrows Point	13.9		14		0	14	41.86	0.64	10.52	1.42	1.37	2.74E-02	2.10E-04	8.23E-02	2965.02	1.83E-02	1.42E-01
		OV5M1	Main Engine - Maneuvering	1	2,500	2,500	0.2						8		12	96	96	10.09	0.15	2.54	0.34	0.33	6.61E-03	5.07E-05	1.98E-02	714.46	4.41E-03	3.42E-02
		OV5AT1	Auxiliary Engines - Transit		199	199	0.56	50	4	200		13.9		14		0	14	2.55	0.03	0.61	0.08	0.08	1.47E-03	1.18E-05	4.42E-03	159.25	9.83E-04	7.62E-03
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.56						8		12	96	96	2.55	0.03	0.61	0.08	0.08	1.47E-03	1.18E-05	4.42E-03	159.25	9.83E-04	7.62E-03
OSS Topside Transport (assume separate from Jacket/piles)	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	4	200	Sparrows Point	13.9		14		0	14	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						8		24	192	192	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		OV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	4	200		13.9		14		0	14	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						8		24	192	192	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Refueling operations to OSS and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.83	50	36	1,800	Norfolk	25		72		0	72	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OV7M1	Main Engine - Maneuvering	2	749	1,498	0.2						72		24	1,728	1728	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OV7AT1	Auxiliary Engines - Transit		20	40	0.56	50	36	1,800		25		72		0	72	0.51	0.01	0.12	0.02	0.02	2.96E-04	2.37E-06	8.89E-04	32.01	1.98E-04	1.53E-03
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.56						72		24	1,728	1728	0.51	0.01	0.12	0.02	0.02	2.96E-04	2.37E-06	8.89E-04	32.01	1.98E-04	1.53E-03
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.83	50	4	200	Sparrows Point	6		33		0	33	86.26	1.20	19.78	2.67	2.58	1.12E-01	3.87E-04	1.55E-01	5564.95	3.44E-02	2.67E-01
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.2						540		1	540	540	20.79	0.29	4.77	0.64	0.62	2.69E-02	9.33E-05	3.73E-02	1340.95	8.29E-03	6.42E-02
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	4	200		6		33		0	33	21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43						540		1	540	540	21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02
OSS emergency generators	150 kW standard diesel generator	OD1	Engine	4	150	600	1.00	N/A	N/A	N/A	N/A	N/A	365	0	24	1000	8760	0.53	0.25	4.63	0.04	0.04	8.99E-03	0.00E+00	2.33E-02	978.31	3.97E-02	7.94E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-13
US Wind, Inc. - Maryland Offshore Wind Project
Inter-Array Cable Installation - Short-Term Emissions

Vessel Information												Operation and Short-Term Emissions																
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
OCS Air Permit Emissions During Construction																												
Inter-Array Cable Installation																												
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	IV1T1	Main Engine - In Transit		1,750	5,250	0.83	50	12	600	Sparrows Point	14		43		0	43	91.17	2.40	21.13	3.27	3.17	8.17E-01	3.75E-04	2.59E-01	6100.31	3.84E-02	2.98E-01
		IV1M1	Main Engine - Maneuvering		1,750	5,250	0.2						130		24	3,127	3127	21.97	0.58	5.09	0.79	0.76	1.97E-01	9.03E-05	6.25E-02	1469.95	9.26E-03	7.18E-02
		IV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.56	50	12	600		14		43		0	43	21.37	0.30	5.36	0.69	0.67	1.30E-02	1.04E-04	3.89E-02	1400.43	8.64E-03	6.70E-02
		IV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	0.56						130		24	3,127	3127	21.37	0.30	5.36	0.69	0.67	1.30E-02	1.04E-04	3.89E-02	1400.43	8.64E-03	6.70E-02
Pre-lay grapnel run	Multipurpose offshore support vessel	IV2T1	Main Engine - In Transit		1611	1611	0.83	50	3	150	Sparrows Point	10		15		0	15	28.06	0.53	6.75	0.97	0.94	9.73E-02	1.33E-04	6.19E-02	1897.39	1.18E-02	9.14E-02
		IV2M1	Main Engine - Maneuvering	1	1611	1611	0.2						23		12	274	274	6.76	0.13	1.63	0.23	0.23	2.34E-02	3.20E-05	1.49E-02	457.20	2.84E-03	2.20E-02
		IV2AT1	Auxiliary Engines - Transit		123	246	0.43	50	3	150		10		15		0	15	2.36	0.03	0.58	0.07	0.07	1.40E-03	1.12E-05	4.20E-03	151.16	9.33E-04	7.23E-03
		IV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.43						23		12	274	274	2.36	0.03	0.58	0.07	0.07	1.40E-03	1.12E-05	4.20E-03	151.16	9.33E-04	7.23E-03
Crew transfer vessel 1	Crew transfer vessel	IV3T1	Main Engine - In Transit		749	1,498	0.83	33	300	9,764	Ocean City	25		391		0	391	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		IV3M1	Main Engine - Maneuvering	2	749	1,498	0.2						300		12	3,600	3600	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		IV3AT1	Auxiliary Engines - Transit		20	40	0.43	33	300	9,764		25		391		0	391	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		IV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						300		12	3,600	3600	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Crew transfer vessel 2	Crew transfer vessel	IV4T1	Main Engine - In Transit		749	1,498	0.83	33	300	9,764	Ocean City	25		391		0	391	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		IV4M1	Main Engine - Maneuvering	2	749	1,498	0.2						300		12	3,600	3600	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		IV4AT1	Auxiliary Engines - Transit		20	40	0.43	33	300	9,764		25		391		0	391	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		IV4AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						300		12	3,600	3600	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Trenching vessel	Purpose-built offshore construction/ROV/survey vessel	IV5T1	Main Engine - In Transit		3,000	15,000	0.83	50	3	150	Sparrows Point	10		15		0	15	260.47	6.86	60.38	9.33	9.06	2.33E+00	1.07E-03	7.41E-01	17429.45	1.10E-01	8.51E-01
		IV5M1	Main Engine - Maneuvering		3,000	15,000	0.2						130		24	3,120	3120	62.76	1.65	14.55	2.25	2.18	5.62E-01	2.58E-04	1.79E-01	4199.87	2.65E-02	2.05E-01
		IV5AT1	Auxiliary Engines - Transit		3,000	3,000	0.27	50	3	150		10		15		0	15	17.66	0.25	4.43	0.57	0.55	1.07E-02	8.57E-05	3.21E-02	1157.50	7.14E-03	5.54E-02
		IV5AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	0.45						130		24	3,120	3120	29.43	0.42	7.38	0.95	0.92	1.79E-02	1.43E-04	5.36E-02	1929.17	1.19E-02	9.23E-02
Guard vessel	Crew transfer vessel	IV6T1	Main Engine - In Transit		749	1,498	0.83	33	10	325	Ocean City	13.5		24		0	24	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		IV6M1	Main Engine - Maneuvering	2	749	1,498	0.2						30		24	720	720	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		IV6AT1	Auxiliary Engines - Transit		20	40	0.43	33	10	325		13.5		24		0	24	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		IV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						30		24	720	720	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-14
US Wind, Inc. - Maryland Offshore Wind Project
Offshore Export Cable Installation - Short-Term Emissions

Vessel Information												Operation and Short-Term Emissions																
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
OCS Air Permit Emissions During Construction																												
Offshore Export Cable Installation																												
Offshore export cable pre-lay survey, trenching, cable lay and pull	Cable lay vessel	ECV1T1	Main Engine - In Transit		1,750	5,250	0.83	50	4	200	Sparrows Point	14		14		0	14	91.17	2.40	21.13	3.27	3.17	8.17E-01	3.75E-04	2.59E-01	6100.31	3.84E-02	2.98E-01
		ECV1M1	Main Engine - Maneuvering		1,750	5,250	0.2						120		24	2,880	2880	21.97	0.58	5.09	0.79	0.76	1.97E-01	9.03E-05	6.25E-02	1469.95	9.26E-03	7.18E-02
		ECV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.56	50	4	200		14		14		0	14	21.37	0.30	5.36	0.69	0.67	1.30E-02	1.04E-04	3.89E-02	1400.43	8.64E-03	6.70E-02
		ECV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	0.56						120		24	2,880	2880	21.37	0.30	5.36	0.69	0.67	1.30E-02	1.04E-04	3.89E-02	1400.43	8.64E-03	6.70E-02
Pre-lay grapnel run & pre-lay survey; post lay survey after completion	Multipurpose offshore support vessel	ECV2T1	Main Engine - In Transit		1,611	1,611	0.83	50	6	300	Sparrows Point	10		30		0	30	27.97	0.74	6.49	1.00	0.97	2.51E-01	1.15E-04	7.96E-02	1871.92	1.18E-02	9.14E-02
		ECV2M1	Main Engine - Maneuvering	1	1,611	1,611	0.2						40		24	960	960	6.74	0.18	1.56	0.24	0.23	6.04E-02	2.77E-05	1.92E-02	451.07	2.84E-03	2.20E-02
		ECV2AT1	Auxiliary Engines - Transit		123	246	0.43	50	6	300		10		30		0	30	2.31	0.03	0.58	0.07	0.07	1.40E-03	1.12E-05	4.20E-03	151.16	9.33E-04	7.23E-03
		ECV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.43						40		24	960	960	2.31	0.03	0.58	0.07	0.07	1.40E-03	1.12E-05	4.20E-03	151.16	9.33E-04	7.23E-03
Trenching vessel	Purpose built offshore construction/survey vessel	ECV3T1	Main Engine - In Transit		3,000	15,000	0.83	50	3	150	Sparrows Point	10		15		0	15	260.47	6.86	60.38	9.33	9.06	2.33E+00	1.07E-03	7.41E-01	17429.45	1.10E-01	8.51E-01
		ECV3M1	Main Engine - Maneuvering		3,000	15,000	0.2						120		24	2,880	2880	62.76	1.65	14.55	2.25	2.18	5.62E-01	2.58E-04	1.79E-01	4199.87	2.65E-02	2.05E-01
		ECV3AT1	Auxiliary Engines - Transit		3,000	3,000	0.27	50	3	150		10		15		0	15	17.66	0.25	4.43	0.57	0.55	1.07E-02	8.57E-05	3.21E-02	1157.50	7.14E-03	5.54E-02
		ECV3AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	0.45						120		24	2,880	2880	29.43	0.42	7.38	0.95	0.92	1.79E-02	1.43E-04	5.36E-02	1929.17	1.19E-02	9.23E-02
HDD pull in lift vessel	Jack-up vessel	ECV4T1	Main Engine - In Transit		2,350	4,700	0.83	50	4	200	Leesburg, NJ	6		33		0	33	86.26	1.20	19.78	2.67	2.58	1.12E-01	3.87E-04	1.55E-01	5564.95	3.44E-02	2.67E-01
		ECV4M1	Main Engine - Maneuvering	2	2,350	4,700	0.00						56		12	672	672	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		ECV4AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	4	200		6		33		0	33	21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02
		ECV4AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43						56		12	672	672	21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02
Diving support for HDD pull in	Research / Survey	ECV5T1	Main Engine - In Transit		392	784	0.83	50	4	200	Leesburg, NJ	15		13	0	0	13	14.14	0.32	3.23	0.49	0.47	9.47E-02	6.03E-05	3.59E-02	915.63	5.74E-03	4.45E-02
		ECV5M1	Main Engine - Maneuvering	2	392	784	0.2						56		12	672	672	3.41	0.08	0.78	0.12	0.11	2.28E-02	1.45E-05	8.64E-03	220.63	1.38E-03	1.07E-02
		ECV5AT1	Auxiliary Engines - Transit		135	270	0.43	50	4	200		15		13	0	0	13	2.61	0.04	0.63	0.08	0.08	1.54E-03	1.23E-05	4.61E-03	165.91	1.02E-03	7.93E-03
		ECV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43						56		12	672	672	2.61	0.04	0.63	0.08	0.08	1.54E-03	1.23E-05	4.61E-03	165.91	1.02E-03	7.93E-03
HDD pull in support vessel	Multipurpose offshore support vessel	ECV6T1	Main Engine - In Transit		1,611	1,611	0.83	50	56	2,800	Lewes, DE	15		187	0	0	187	27.97	0.74	6.49	1.00	0.97	2.51E-01	1.15E-04	7.96E-02	1871.92	1.18E-02	9.14E-02
		ECV6M1	Main Engine - Maneuvering	1	1,611	1,611	0.2						56		12	672	672	6.74	0.18	1.56	0.24	0.23	6.04E-02	2.77E-05	1.92E-02	451.07	2.84E-03	2.20E-02
		ECV6AT1	Auxiliary Engines - Transit		123	246	0.43	50	56	2,800		15		187	0	0	187	2.31	0.03	0.58	0.07	0.07	1.40E-03	1.12E-05	4.20E-03	151.16	9.33E-04	7.23E-03
		ECV6AM1	Auxiliary Engines - Maneuvering	2	123	246	0.43						56		12	672	672	2.31	0.03	0.58	0.07	0.07	1.40E-03	1.12E-05	4.20E-03	151.16	9.33E-04	7.23E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-15
US Wind, Inc. - Maryland Offshore Wind Project
Met Tower Installation - Short-Term Emissions

Vessel Information												Operation and Short-Term Emissions																
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project Centroid	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Operating Hours	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
Met Tower Installation Air Permit Emissions During Construction																												
Met Tower Installation																												
Met Tower installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.83	50	1	50	Sparrows Point	14		4		0	4	412.94	5.76	94.69	12.76	12.35	5.35E-01	1.85E-03	7.41E-01	26640.69	1.65E-01	1.28E+00
		OV1M1	Main Engine - Maneuvering		4,500	22,500	0.00						7		24	168	168	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.27	50	1	50		14		4		0	4	30.94	0.38	6.64	0.86	0.83	1.61E-02	1.29E-04	4.82E-02	1736.25	1.07E-02	8.30E-02
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	0.45						7		24	168	168	51.56	0.63	11.07	1.43	1.38	2.68E-02	2.14E-04	8.04E-02	2893.75	1.79E-02	1.38E-01
Assisting tug	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	13.9		4		0	4	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						7		24	168	168	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		OV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						7		24	168	168	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Met Tower PilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	13.9		4		0	4	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						5		24	120	120	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		OV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						5		24	120	120	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.83	50	1	50	Sparrows Point	13.9		4		0	4	110.84	1.70	27.86	3.76	3.63	7.27E-02	5.57E-04	2.18E-01	7851.37	4.85E-02	3.76E-01
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.2						2		12	24	24	26.71	0.41	6.71	0.90	0.88	1.75E-02	1.34E-04	5.25E-02	1891.90	1.17E-02	9.05E-02
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.27	50	1	50		13.9		4		0	4	9.26	0.12	2.21	0.29	0.28	5.35E-03	4.28E-05	1.60E-02	577.59	3.56E-03	2.76E-02
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45						2		12	24	24	15.43	0.21	3.68	0.48	0.46	8.91E-03	7.13E-05	2.67E-02	962.65	5.94E-03	4.60E-02
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,540	2,500	0.83	50	1	50	Sparrows Point	13.9		4		0	4	41.86	0.64	10.52	1.42	1.37	2.74E-02	2.10E-04	8.23E-02	2965.02	1.83E-02	1.42E-01
		OV5M1	Main Engine - Maneuvering	2	2,540	2,500	0.2						2		12	24	24	10.09	0.15	2.54	0.34	0.33	6.61E-03	5.07E-05	1.98E-02	714.46	4.41E-03	3.42E-02
		OV5AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	1.96	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						2		12	24	24	1.96	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Met Tower Topside Transport	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	13.9		4		0	4	88.49	1.67	21.29	3.07	2.97	3.07E-01	4.18E-04	1.95E-01	5983.09	3.72E-02	2.88E-01
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2						2		24	48	48	21.32	0.40	5.13	0.74	0.72	7.39E-02	1.01E-04	4.70E-02	1441.71	8.96E-03	6.94E-02
		OV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		13.9		4		0	4	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43						2		24	48	48	1.91	0.03	0.47	0.06	0.06	1.13E-03	9.06E-06	3.40E-03	122.28	7.55E-04	5.85E-03
Refueling operations to Met Tower and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit	2	749	1,498	0.83	50	9	450	Norfolk	25		18		0	18	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OV7M1	Main Engine - Maneuvering		749	1,498	0.2						18		24	432	432	6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OV7AT1	Auxiliary Engines - Transit	2	20	40	0.43	50	9	450		25		18		0	18	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		OV7AM1	Auxiliary Engines - Maneuvering		20	40	0.43						18		24	432	432	0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
															0.00													
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows Point	6		8		0	8	86.26	1.20	19.78	2.67	2.58	1.12E-01	3.87E-04	1.55E-01	5564.95	3.44E-02	2.67E-01
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.2						135		1	135	135	20.79	0.29	4.77	0.64	0.62	2.69E-02	9.33E-05	3.73E-02	1340.95	8.29E-03	6.42E-02
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		6		8		0	8	21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43						135		1	135	135	21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-16
US Wind, Inc. - Maryland Offshore Wind Project
Foundation Installation - Annual Emissions - Year 1

Vessel Information							Year 1										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Scour Protection Installation																	
Scour protection installation vessel	Fallpipe vessel	FV1T1	Main Engine - In Transit		4,500	13,500	0.73	1.93E-02	0.17	2.62E-02	2.54E-02	6.55E-03	3.01E-06	2.08E-03	48.96	3.08E-04	2.39E-03
		FV1M1	Main Engine - Maneuvering	3	4,500	13,500	10.94	2.88E-01	2.54	3.92E-01	3.80E-01	9.80E-02	4.50E-05	3.11E-02	732.11	4.61E-03	3.57E-02
		FV1AT1	Auxiliary Engines - Transit		492	492	0.01	1.28E-04	0.00	2.93E-04	2.83E-04	5.48E-06	4.39E-08	1.65E-05	0.59	3.66E-06	2.83E-05
		FV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	2.28	3.23E-02	0.57	7.38E-02	7.15E-02	1.38E-03	1.11E-05	4.15E-03	149.46	9.22E-04	7.15E-03
Foundation Installation																	
Foundation installation vessel	Heavy lift vessel	FV2T1	Main Engine - In Transit		4,500	22,500	0.51	7.15E-03	0.12	1.58E-02	1.53E-02	6.63E-04	2.30E-06	9.19E-04	33.03	2.04E-04	1.58E-03
		FV2M1	Main Engine - Maneuvering		4,500	22,500	17.72	2.47E-01	4.06	5.48E-01	5.30E-01	2.30E-02	7.95E-05	3.18E-02	1143.09	7.07E-03	5.48E-02
		FV2AT1	Auxiliary Engines - Transit		4500	4500	0.04	4.65E-04	0.01	1.06E-03	1.03E-03	1.99E-05	1.59E-07	5.98E-05	2.15	1.33E-05	1.03E-04
		FV2AM1	Auxiliary Engines - Maneuvering	6	4500	4500	18.36	2.23E-01	3.94	5.09E-01	4.93E-01	9.54E-03	7.63E-05	2.86E-02	1030.56	6.36E-03	4.93E-02
Tug for assisting foundation installation 1 -- Offshore	Tug	FV3T1	Main Engine - In Transit		2,540	5,080	0.25	4.70E-03	0.06	8.62E-03	8.36E-03	8.62E-04	1.18E-06	5.48E-04	16.81	1.04E-04	8.10E-04
		FV3M1	Main Engine - Maneuvering	2	2,540	5,080	3.80	7.18E-02	0.91	1.32E-01	1.28E-01	1.32E-02	1.79E-05	8.38E-03	256.72	1.60E-03	1.24E-02
		FV3AT1	Auxiliary Engines - Transit		199	199	0.01	7.42E-05	0.00	1.70E-04	1.64E-04	3.18E-06	2.54E-08	9.54E-06	0.34	2.12E-06	1.64E-05
		FV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.34	4.70E-03	0.08	1.07E-02	1.04E-02	2.02E-04	1.61E-06	6.05E-04	21.77	1.34E-04	1.04E-03
Foundation transport tug 1	Tug	FV4T1	Main Engine - In Transit		2,540	5,080	0.58	1.10E-02	0.14	2.01E-02	1.95E-02	2.01E-03	2.74E-06	1.28E-03	39.22	2.44E-04	1.89E-03
		FV4M1	Main Engine - Maneuvering	2	2,540	5,080	1.05	1.98E-02	0.25	3.64E-02	3.53E-02	3.64E-03	4.96E-06	2.31E-03	70.94	4.41E-04	3.42E-03
		FV4AT1	Auxiliary Engines - Transit		199	199	0.01	1.73E-04	0.00	3.96E-04	3.83E-04	7.42E-06	5.94E-08	2.23E-05	0.80	4.95E-06	3.83E-05
		FV4AM1	Auxiliary Engines - Maneuvering	1	199	199	0.09	1.30E-03	0.02	2.97E-03	2.88E-03	5.57E-05	4.46E-07	1.67E-04	6.02	3.71E-05	2.88E-04
Foundation transport tug 2	Tug	FV5T1	Main Engine - In Transit		2,540	5,080	0.55	1.04E-02	0.13	1.92E-02	1.86E-02	1.92E-03	2.61E-06	1.22E-03	37.35	2.32E-04	1.80E-03
		FV5M1	Main Engine - Maneuvering	2	2,540	5,080	1.00	1.89E-02	0.24	3.46E-02	3.36E-02	3.46E-03	4.72E-06	2.20E-03	67.56	4.20E-04	3.25E-03
		FV5AT1	Auxiliary Engines - Transit		199	199	0.01	1.65E-04	0.00	3.77E-04	3.65E-04	7.07E-06	5.65E-08	2.12E-05	0.76	4.71E-06	3.65E-05
		FV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.09	1.24E-03	0.02	2.83E-03	2.74E-03	5.30E-05	4.24E-07	1.59E-04	5.73	3.54E-05	2.74E-04
Foundation transport tug 3	Tug	FV6T1	Main Engine - In Transit		2,540	5,080	0.47	8.88E-03	0.11	1.63E-02	1.58E-02	1.63E-03	2.22E-06	1.04E-03	31.75	1.97E-04	1.53E-03
		FV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.85	1.61E-02	0.20	2.94E-02	2.85E-02	2.94E-03	4.01E-06	1.87E-03	57.42	3.57E-04	2.77E-03
		FV6AT1	Auxiliary Engines - Transit		199	199	0.01	1.40E-04	0.00	3.20E-04	3.10E-04	6.01E-06	4.81E-08	1.80E-05	0.65	4.00E-06	3.10E-05
		FV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.08	1.05E-03	0.02	2.40E-03	2.33E-03	4.51E-05	3.61E-07	1.35E-04	4.87	3.01E-05	2.33E-04
Crew transfer vessel 1	Crew transfer vessel	FV7T1	Main Engine - In Transit		749	1,498	0.16	2.47E-03	0.04	5.47E-03	5.30E-03	1.06E-04	8.12E-07	3.18E-04	11.44	7.06E-05	5.47E-04
		FV7M1	Main Engine - Maneuvering	2	749	1,498	0.30	4.57E-03	0.08	1.01E-02	9.80E-03	1.96E-04	1.50E-06	5.88E-04	21.18	1.31E-04	1.01E-03
		FV7AT1	Auxiliary Engines - Transit		20	40	0.00	3.42E-05	0.00	7.81E-05	7.57E-05	1.47E-06	1.17E-08	4.40E-06	0.16	9.77E-07	7.57E-06
		FV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.02	2.63E-04	0.00	6.00E-04	5.81E-04	1.13E-05	9.00E-08	3.38E-05	1.22	7.50E-06	5.81E-05
Noise mitigation vessel	OSV	FV8T1	Main Engine - In Transit		3,310	6,620	0.43	6.62E-03	0.11	1.47E-02	1.42E-02	2.84E-04	2.18E-06	8.51E-04	30.66	1.89E-04	1.47E-03
		FV8M1	Main Engine - Maneuvering	2	3,310	6,620	2.38	3.64E-02	0.60	8.06E-02	7.80E-02	1.56E-03	1.20E-05	4.68E-03	168.44	1.04E-03	8.06E-03
		FV8AT1	Auxiliary Engines - Transit		499	1497	0.04	4.87E-04	0.01	1.11E-03	1.08E-03	2.09E-05	1.67E-07	6.26E-05	2.26	1.39E-05	1.08E-04
		FV8AM1	Auxiliary Engines - Maneuvering	3	499	1497	1.37	1.85E-02	0.33	4.23E-02	4.10E-02	7.93E-04	6.35E-06	2.38E-03	85.71	5.29E-04	4.10E-03
Acoustic monitoring - buoy support vessel	OSV	FV9T1	Main Engine - In Transit		2,540	5,080	0.21	3.25E-03	0.05	7.20E-03	6.96E-03	1.39E-04	1.07E-06	4.18E-04	15.05	9.28E-05	7.20E-04
		FV9M1	Main Engine - Maneuvering	2	2,540	5,080	1.82	2.79E-02	0.46	6.18E-02	5.98E-02	1.20E-03	9.17E-06	3.59E-03	129.26	7.98E-04	6.18E-03
		FV9AT1	Auxiliary Engines - Transit		199	199	0.01	8.59E-05	0.00	1.96E-04	1.90E-04	3.68E-06	2.94E-08	1.10E-05	0.40	2.45E-06	1.90E-05
		FV9AM1	Auxiliary Engines - Maneuvering	1	199	199	0.23	3.06E-03	0.05	7.00E-03	6.78E-03	1.31E-04	1.05E-06	3.94E-04	14.18	8.75E-05	6.78E-04
Marine mammal observation 1	Crew transfer vessel	FV10T1	Main Engine - In Transit		749	1,498	0.81	1.24E-02	0.20	2.74E-02	2.65E-02	5.30E-04	4.06E-06	1.59E-03	57.20	3.53E-04	2.74E-03
		FV10M1	Main Engine - Maneuvering	2	749	1,498	0.36	5.49E-03	0.09	1.22E-02	1.18E-02	2.35E-04	1.80E-06	7.06E-04	25.41	1.57E-04	1.22E-03
		FV10AT1	Auxiliary Engines - Transit		20	40	0.01	1.71E-04	0.00	3.91E-04	3.78E-04	7.33E-06	5.86E-08	2.20E-05	0.79	4.88E-06	3.78E-05
		FV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.02	3.15E-04	0.01	7.20E-04	6.98E-04	1.35E-05	1.08E-07	4.05E-05	1.46	9.00E-06	6.98E-05
Environmental monitoring	Crew transfer vessel	FV11T1	Main Engine - In Transit		749	1,498	0.81	1.24E-02	0.20	2.74E-02	2.65E-02	5.30E-04	4.06E-06	1.59E-03	57.20	3.53E-04	2.74E-03
		FV11M1	Main Engine - Maneuvering	2	749	1,498	0.36	5.49E-03	0.09	1.22E-02	1.18E-02	2.35E-04	1.80E-06	7.06E-04	25.41	1.57E-04	1.22E-03
		FV11AT1	Auxiliary Engines - Transit		20	40	0.01	1.71E-04	0.00	3.91E-04	3.78E-04	7.33E-06	5.86E-08	2.20E-05	0.79	4.88E-06	3.78E-05
		FV11AM1	Auxiliary Engines - Maneuvering	2	20	40	0.02	3.15E-04	0.01	7.20E-04	6.98E-04	1.35E-05	1.08E-07	4.05E-05	1.46	9.00E-06	6.98E-05

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-17
US Wind, Inc. - Maryland Offshore Wind Project
WTG Installation - Annual Emissions - Year 1

Vessel Information							Year 1										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
WTG Installation																	
WTG installation jack-up vessel	Jack-up installation vessel	WV1T1	Main Engine - In Transit	3	3,800	11,400	0.38	5.28E-03	0.09	1.17E-02	1.13E-02	4.90E-04	1.70E-06	6.79E-04	24.40	1.51E-04	1.17E-03
		WV1M1	Main Engine - Maneuvering		3,800	11,400	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		WV1AT1	Auxiliary Engines - Transit	1	2,880	2,880	0.04	4.34E-04	0.01	9.92E-04	9.61E-04	1.86E-05	1.49E-07	5.58E-05	2.01	1.24E-05	9.61E-05
		WV1AM1	Auxiliary Engines - Maneuvering		2,880	2,880	27.49	3.33E-01	5.90	7.62E-01	7.38E-01	1.43E-02	1.14E-04	4.28E-02	1542.82	9.52E-03	7.38E-02
Tug to transport WTG 1	Tug	WV2T1	Main Engine - In Transit	2	2,540	5,080	1.60	3.03E-02	0.39	5.55E-02	5.39E-02	5.55E-03	7.57E-06	3.53E-03	108.32	6.73E-04	5.22E-03
		WV2M1	Main Engine - Maneuvering		2,540	5,080	3.86	7.31E-02	0.93	1.34E-01	1.30E-01	1.34E-02	1.83E-05	8.52E-03	261.22	1.62E-03	1.26E-02
		WV2AT1	Auxiliary Engines - Transit	1	199	199	0.03	4.78E-04	0.01	1.09E-03	1.06E-03	2.05E-05	1.64E-07	6.15E-05	2.21	1.37E-05	1.06E-04
		WV2AM1	Auxiliary Engines - Maneuvering		199	199	0.35	4.79E-03	0.08	1.09E-02	1.06E-02	2.05E-04	1.64E-06	6.15E-04	22.16	1.37E-04	1.06E-03
Tug to transport WTG 2	Tug	WV3T1	Main Engine - In Transit	2	2,540	5,080	1.55	2.92E-02	0.37	5.36E-02	5.20E-02	5.36E-03	7.31E-06	3.41E-03	104.59	6.50E-04	5.04E-03
		WV3M1	Main Engine - Maneuvering		2,540	5,080	3.73	7.05E-02	0.90	1.29E-01	1.25E-01	1.29E-02	1.76E-05	8.23E-03	252.22	1.57E-03	1.21E-02
		WV3AT1	Auxiliary Engines - Transit	1	199	199	0.03	4.62E-04	0.01	1.06E-03	1.02E-03	1.98E-05	1.58E-07	5.94E-05	2.14	1.32E-05	1.02E-04
		WV3AM1	Auxiliary Engines - Maneuvering		199	199	0.33	4.62E-03	0.08	1.06E-02	1.02E-02	1.98E-04	1.58E-06	5.94E-04	21.39	1.32E-04	1.02E-03
Tug to support WTG Installation / maneuvering offshore	Tug	WV4T1	Main Engine - In Transit	2	2,540	5,080	0.44	8.36E-03	0.11	1.53E-02	1.49E-02	1.53E-03	2.09E-06	9.75E-04	29.88	1.86E-04	1.44E-03
		WV4M1	Main Engine - Maneuvering		2,540	5,080	17.76	3.36E-01	4.27	6.16E-01	5.97E-01	6.16E-02	8.40E-05	3.92E-02	1201.03	7.46E-03	5.78E-02
		WV4AT1	Auxiliary Engines - Transit	1	199	199	0.01	1.32E-04	0.00	3.01E-04	2.92E-04	5.65E-06	4.52E-08	1.70E-05	0.61	3.77E-06	2.92E-05
		WV4AM1	Auxiliary Engines - Maneuvering		199	199	1.59	2.20E-02	0.39	5.03E-02	4.87E-02	9.43E-04	7.54E-06	2.83E-03	101.87	6.29E-04	4.87E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-18
US Wind, Inc. - Maryland Offshore Wind Project
WTG Commissioning - Annual Emissions - Year 1

Vessel Information							Year 1										
Activity	**Representative Vessel Type**	**AERMOD ID**	**Engine Type**	**Number of Engines**	**Individual Equipment Size (kW)**	**Total Equipment Size (kW)**	**NOx (ton/year)**	**VOC (ton/year)**	**CO (ton/year)**	**PM10 (ton/year)**	**PM2.5 (ton/year)**	**SO2 (ton/year)**	**Pb (ton/year)**	**HAPs (ton/year)**	**CO2 (ton/year)**	**CH4 (ton/year)**	**N2O (ton/year)**
OCS Air Permit Emissions During Construction																	
WTG Commissioning																	
Crew transfer vessel 1	Crew transfer vessel	CV1T1	Main Engine - In Transit		749	1,498	1.03	1.57E-02	0.26	3.48E-02	3.37E-02	6.74E-04	5.17E-06	2.02E-03	72.86	4.50E-04	3.48E-03
		CV1M1	Main Engine - Maneuvering	2	749	1,498	2.35	3.59E-02	0.59	7.95E-02	7.70E-02	1.54E-03	1.18E-05	4.62E-03	166.28	1.03E-03	7.95E-03
		CV1AT1	Auxiliary Engines - Transit		20	40	0.02	2.18E-04	0.00	4.98E-04	4.82E-04	9.33E-06	7.46E-08	2.80E-05	1.01	6.22E-06	4.82E-05
		CV1AM1	Auxiliary Engines - Maneuvering	2	20	40	0.15	2.06E-03	0.04	4.71E-03	4.57E-03	8.84E-05	7.07E-07	2.65E-04	9.55	5.89E-05	4.57E-04
Crew transfer vessel 2	Crew transfer vessel	CV2T1	Main Engine - In Transit		749	1,498	1.02	1.56E-02	0.26	3.45E-02	3.34E-02	6.67E-04	5.11E-06	2.00E-03	72.06	4.45E-04	3.45E-03
		CV2M1	Main Engine - Maneuvering	2	749	1,498	2.32	3.55E-02	0.58	7.87E-02	7.61E-02	1.52E-03	1.17E-05	4.57E-03	164.50	1.02E-03	7.87E-03
		CV2AT1	Auxiliary Engines - Transit		20	40	0.02	2.15E-04	0.00	4.92E-04	4.77E-04	9.23E-06	7.38E-08	2.77E-05	1.00	6.15E-06	4.77E-05
		CV2AM1	Auxiliary Engines - Maneuvering	2	20	40	0.15	2.04E-03	0.04	4.66E-03	4.52E-03	8.74E-05	6.99E-07	2.62E-04	9.44	5.83E-05	4.52E-04
Crew transfer vessel 3 per GE	Crew transfer vessel	CV3T1	Main Engine - In Transit		749	1,498	0.60	9.10E-03	0.15	2.02E-02	1.95E-02	3.90E-04	2.99E-06	1.17E-03	42.15	2.60E-04	2.02E-03
		CV3M1	Main Engine - Maneuvering	2	749	1,498	1.38	2.12E-02	0.35	4.69E-02	4.54E-02	9.08E-04	6.96E-06	2.72E-03	98.08	6.05E-04	4.69E-03
		CV3AT1	Auxiliary Engines - Transit		20	40	0.01	1.26E-04	0.00	2.88E-04	2.79E-04	5.40E-06	4.32E-08	1.62E-05	0.58	3.60E-06	2.79E-05
		CV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.09	1.22E-03	0.02	2.78E-03	2.69E-03	5.21E-05	4.17E-07	1.56E-04	5.63	3.47E-05	2.69E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-19
US Wind, Inc. - Maryland Offshore Wind Project
OSS Installation - Annual Emissions - Year 1

Vessel Information							Year 1										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
OSS Installation																	
OSS installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.51	7.15E-03	0.12	1.58E-02	1.53E-02	6.63E-04	2.30E-06	9.19E-04	33.03	2.04E-04	1.58E-03
		OV1M1	Main Engine - Maneuvering		4,500	22,500	2.90	4.05E-02	0.67	8.97E-02	8.68E-02	3.76E-03	1.30E-05	5.21E-03	187.17	1.16E-03	8.97E-03
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.04	4.65E-04	0.01	1.06E-03	1.03E-03	1.99E-05	1.59E-07	5.98E-05	2.15	1.33E-05	1.03E-04
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	3.01	3.64E-02	0.65	8.33E-02	8.07E-02	1.56E-03	1.25E-05	4.69E-03	168.75	1.04E-03	8.07E-03
Assisting tug for OSS Jacket and topside install	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.11	2.09E-03	0.03	3.83E-03	3.71E-03	3.83E-04	5.22E-07	2.44E-04	7.47	4.64E-05	3.60E-04
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	1.24	2.35E-02	0.30	4.31E-02	4.18E-02	4.31E-03	5.88E-06	2.74E-03	84.07	5.22E-04	4.05E-03
		OV2AT1	Auxiliary Engines - Transit		199	199	0.00	3.30E-05	0.00	7.54E-05	7.30E-05	1.41E-06	1.13E-08	4.24E-06	0.15	9.42E-07	7.30E-06
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.11	1.54E-03	0.03	3.52E-03	3.41E-03	6.60E-05	5.28E-07	1.98E-04	7.13	4.40E-05	3.41E-04
OSS Jacket and pilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.11	2.09E-03	0.03	3.83E-03	3.71E-03	3.83E-04	5.22E-07	2.44E-04	7.47	4.64E-05	3.60E-04
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.89	1.68E-02	0.21	3.08E-02	2.99E-02	3.08E-03	4.20E-06	1.96E-03	60.05	3.73E-04	2.89E-03
		OV3AT1	Auxiliary Engines - Transit		199	199	0.00	4.29E-05	0.00	9.82E-05	9.51E-05	1.84E-06	1.47E-08	5.52E-06	0.20	1.23E-06	9.51E-06
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.10	1.43E-03	0.03	3.27E-03	3.17E-03	6.14E-05	4.91E-07	1.84E-04	6.63	4.09E-05	3.17E-04
OSS Jacket Install Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.14	2.12E-03	0.03	4.69E-03	4.54E-03	9.07E-05	6.96E-07	2.72E-04	9.80	6.05E-05	4.69E-04
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.22	3.40E-03	0.06	7.54E-03	7.29E-03	1.46E-04	1.12E-06	4.38E-04	15.76	9.73E-05	7.54E-04
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.01	1.56E-04	0.00	3.56E-04	3.45E-04	6.68E-06	5.34E-08	2.00E-05	0.72	4.45E-06	3.45E-05
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.13	1.73E-03	0.03	3.96E-03	3.84E-03	7.42E-05	5.94E-07	2.23E-04	8.02	4.95E-05	3.84E-04
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,500	2,500	0.05	8.00E-04	0.01	1.77E-03	1.71E-03	3.43E-05	2.63E-07	1.03E-04	3.70	2.28E-05	1.77E-04
		OV5M1	Main Engine - Maneuvering	1	2,500	2,500	0.08	1.29E-03	0.02	2.85E-03	2.75E-03	5.51E-05	4.22E-07	1.65E-04	5.95	3.67E-05	2.85E-04
		OV5AT1	Auxiliary Engines - Transit		199	199	0.00	4.29E-05	0.00	9.82E-05	9.51E-05	1.84E-06	1.47E-08	5.52E-06	0.20	1.23E-06	9.51E-06
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.02	2.87E-04	0.01	6.55E-04	6.34E-04	1.23E-05	9.82E-08	3.68E-05	1.33	8.19E-06	6.34E-05
OSS Topside Transport (assume separate from Jacket/piles)	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.11	2.09E-03	0.03	3.83E-03	3.71E-03	3.83E-04	5.22E-07	2.44E-04	7.47	4.64E-05	3.60E-04
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.36	6.72E-03	0.09	1.23E-02	1.19E-02	1.23E-03	1.68E-06	7.84E-04	24.02	1.49E-04	1.16E-03
		OV6AT1	Auxiliary Engines - Transit		199	199	0.00	3.30E-05	0.00	7.54E-05	7.30E-05	1.41E-06	1.13E-08	4.24E-06	0.15	9.42E-07	7.30E-06
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.03	4.40E-04	0.01	1.01E-03	9.74E-04	1.89E-05	1.51E-07	5.66E-05	2.04	1.26E-05	9.74E-05
Refueling operations to OSS and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.16	2.40E-03	0.04	5.31E-03	5.14E-03	1.03E-04	7.88E-07	3.08E-04	11.10	6.85E-05	5.31E-04
		OV7M1	Main Engine - Maneuvering	2	749	1,498	0.91	1.39E-02	0.23	3.07E-02	2.97E-02	5.94E-04	4.56E-06	1.78E-03	64.19	3.96E-04	3.07E-03
		OV7AT1	Auxiliary Engines - Transit		20	40	0.00	4.32E-05	0.00	9.87E-05	9.56E-05	1.85E-06	1.48E-08	5.55E-06	0.20	1.23E-06	9.56E-06
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.08	1.04E-03	0.02	2.37E-03	2.30E-03	4.44E-05	3.55E-07	1.33E-04	4.80	2.96E-05	2.30E-04
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.25	3.48E-03	0.06	7.71E-03	7.46E-03	3.23E-04	1.12E-06	4.48E-04	16.10	9.95E-05	7.71E-04
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.97	1.36E-02	0.22	3.01E-02	2.91E-02	1.26E-03	4.37E-06	1.75E-03	62.84	3.88E-04	3.01E-03
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.06	7.68E-04	0.01	1.75E-03	1.70E-03	3.29E-05	2.63E-07	9.87E-05	3.55	2.19E-05	1.70E-04
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	1.03	1.24E-02	0.22	2.84E-02	2.75E-02	5.33E-04	4.26E-06	1.60E-03	57.59	3.55E-04	2.75E-03
OSS emergency generators	150 kW standard diesel generator	OD1	Engine	4	150	600	0.26	1.26E-01	2.31	1.98E-02	1.98E-02	4.50E-03	0.00E+00	1.16E-02	489.15	1.98E-02	3.97E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-20
US Wind, Inc. - Maryland Offshore Wind Project
Inter-Array Cable Installation - Annual Emissions - Year 1

Vessel Information							Year 1										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Inter-Array Cable Installation																	
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	IV1T1	Main Engine - In Transit		1,750	5,250	0.34	8.93E-03	0.08	1.21E-02	1.18E-02	3.04E-03	1.39E-06	9.65E-04	22.69	1.43E-04	1.11E-03
		IV1M1	Main Engine - Maneuvering		1,750	5,250	5.96	1.57E-01	1.38	2.14E-01	2.07E-01	5.34E-02	2.45E-05	1.70E-02	398.86	2.51E-03	1.95E-02
		IV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.08	1.12E-03	0.02	2.57E-03	2.49E-03	4.82E-05	3.86E-07	1.45E-04	5.21	3.21E-05	2.49E-04
		IV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	5.80	8.21E-02	1.45	1.88E-01	1.82E-01	3.52E-03	2.81E-05	1.06E-02	379.99	2.34E-03	1.82E-02
Pre-lay grapnel run	Multipurpose offshore support vessel	IV2T1	Main Engine - In Transit		1611	1611	0.04	6.91E-04	0.01	1.27E-03	1.23E-03	1.27E-04	1.73E-07	8.06E-05	2.47	1.53E-05	1.19E-04
		IV2M1	Main Engine - Maneuvering	1	1611	1611	0.16	3.04E-03	0.04	5.57E-03	5.40E-03	5.57E-04	7.59E-07	3.54E-04	10.85	6.75E-05	5.23E-04
		IV2AT1	Auxiliary Engines - Transit		123	246	0.00	4.25E-05	0.00	9.71E-05	9.41E-05	1.82E-06	1.46E-08	5.46E-06	0.20	1.21E-06	9.41E-06
		IV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.06	7.75E-04	0.01	1.77E-03	1.72E-03	3.32E-05	2.66E-07	9.97E-05	3.59	2.21E-05	1.72E-04
Crew transfer vessel 1	Crew transfer vessel	IV3T1	Main Engine - In Transit		749	1,498	0.85	1.30E-02	0.21	2.88E-02	2.79E-02	5.57E-04	4.27E-06	1.67E-03	60.22	3.72E-04	2.88E-03
		IV3M1	Main Engine - Maneuvering	2	749	1,498	1.89	2.89E-02	0.47	6.40E-02	6.19E-02	1.24E-03	9.49E-06	3.71E-03	133.74	8.25E-04	6.40E-03
		IV3AT1	Auxiliary Engines - Transit		20	40	0.01	1.80E-04	0.00	4.11E-04	3.98E-04	7.71E-06	6.17E-08	2.31E-05	0.83	5.14E-06	3.98E-05
		IV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.12	1.66E-03	0.03	3.79E-03	3.67E-03	7.11E-05	5.69E-07	2.13E-04	7.68	4.74E-05	3.67E-04
Crew transfer vessel 2	Crew transfer vessel	IV4T1	Main Engine - In Transit		749	1,498	0.85	1.30E-02	0.21	2.88E-02	2.79E-02	5.57E-04	4.27E-06	1.67E-03	60.22	3.72E-04	2.88E-03
		IV4M1	Main Engine - Maneuvering	2	749	1,498	1.89	2.89E-02	0.47	6.40E-02	6.19E-02	1.24E-03	9.49E-06	3.71E-03	133.74	8.25E-04	6.40E-03
		IV4AT1	Auxiliary Engines - Transit		20	40	0.01	1.80E-04	0.00	4.11E-04	3.98E-04	7.71E-06	6.17E-08	2.31E-05	0.83	5.14E-06	3.98E-05
		IV4AM1	Auxiliary Engines - Maneuvering	2	20	40	0.12	1.66E-03	0.03	3.79E-03	3.67E-03	7.11E-05	5.69E-07	2.13E-04	7.68	4.74E-05	3.67E-04
Trenching vessel	Purpose-built offshore construction/ROV/survey vessel	IV5T1	Main Engine - In Transit		3,000	15,000	0.34	8.93E-03	0.08	1.21E-02	1.18E-02	3.04E-03	1.39E-06	9.65E-04	22.69	1.43E-04	1.11E-03
		IV5M1	Main Engine - Maneuvering		3,000	15,000	16.99	4.48E-01	3.94	6.09E-01	5.91E-01	1.52E-01	6.98E-05	4.83E-02	1137.09	7.16E-03	5.55E-02
		IV5AT1	Auxiliary Engines - Transit		3,000	3,000	0.02	3.25E-04	0.01	7.44E-04	7.21E-04	1.39E-05	1.12E-07	4.18E-05	1.51	9.30E-06	7.21E-05
		IV5AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	7.97	1.13E-01	2.00	2.58E-01	2.50E-01	4.83E-03	3.87E-05	1.45E-02	522.31	3.22E-03	2.50E-02
Guard vessel	Crew transfer vessel	IV6T1	Main Engine - In Transit		749	1,498	0.05	8.03E-04	0.01	1.78E-03	1.72E-03	3.44E-05	2.64E-07	1.03E-04	3.72	2.29E-05	1.78E-04
		IV6M1	Main Engine - Maneuvering	2	749	1,498	0.38	5.78E-03	0.09	1.28E-02	1.24E-02	2.48E-04	1.90E-06	7.43E-04	26.75	1.65E-04	1.28E-03
		IV6AT1	Auxiliary Engines - Transit		20	40	0.00	1.11E-05	0.00	2.54E-05	2.46E-05	4.76E-07	3.81E-09	1.43E-06	0.05	3.17E-07	2.46E-06
		IV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.02	3.32E-04	0.01	7.58E-04	7.34E-04	1.42E-05	1.14E-07	4.26E-05	1.54	9.48E-06	7.34E-05

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-21
US Wind, Inc. - Maryland Offshore Wind Project
Offshore Export Cable Installation - Annual Emissions - Year 1

Vessel Information							Year 1										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Offshore Export Cable Installation																	
Offshore export cable pre-lay survey, trenching, cable lay and pull	Cable lay vessel	ECV1T1	Main Engine - In Transit		1,750	5,250	0.11	2.98E-03	0.03	4.05E-03	3.93E-03	1.01E-03	4.64E-07	3.22E-04	7.56	4.76E-05	3.69E-04
		ECV1M1	Main Engine - Maneuvering		1,750	5,250	5.49	1.45E-01	1.27	1.97E-01	1.91E-01	4.92E-02	2.26E-05	1.56E-02	367.37	2.31E-03	1.79E-02
		ECV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.03	3.75E-04	0.01	8.57E-04	8.30E-04	1.61E-05	1.29E-07	4.82E-05	1.74	1.07E-05	8.30E-05
		ECV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	5.34	7.56E-02	1.34	1.73E-01	1.67E-01	3.24E-03	2.59E-05	9.72E-03	349.99	2.16E-03	1.67E-02
Pre-lay grapnel run & pre-lay survey; post lay survey after completion	Multipurpose offshore support vessel	ECV2T1	Main Engine - In Transit		1,611	1,611	0.07	1.92E-03	0.02	2.61E-03	2.53E-03	6.52E-04	2.99E-07	2.07E-04	4.87	3.07E-05	2.38E-04
		ECV2M1	Main Engine - Maneuvering	1	1,611	1,611	0.56	1.48E-02	0.13	2.01E-02	1.95E-02	5.03E-03	2.31E-06	1.60E-03	37.58	2.37E-04	1.83E-03
		ECV2AT1	Auxiliary Engines - Transit		123	246	0.01	8.50E-05	0.00	1.94E-04	1.88E-04	3.64E-06	2.91E-08	1.09E-05	0.39	2.43E-06	1.88E-05
		ECV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.19	2.72E-03	0.05	6.22E-03	6.02E-03	1.17E-04	9.32E-07	3.50E-04	12.59	7.77E-05	6.02E-04
Trenching vessel	Purpose built offshore construction/survey vessel	ECV3T1	Main Engine - In Transit		3,000	15,000	0.34	8.93E-03	0.08	1.21E-02	1.18E-02	3.04E-03	1.39E-06	9.65E-04	22.69	1.43E-04	1.11E-03
		ECV3M1	Main Engine - Maneuvering		3,000	15,000	15.69	4.13E-01	3.64	5.62E-01	5.45E-01	1.40E-01	6.45E-05	4.46E-02	1049.62	6.61E-03	5.12E-02
		ECV3AT1	Auxiliary Engines - Transit		3,000	3,000	0.02	3.25E-04	0.01	7.44E-04	7.21E-04	1.39E-05	1.12E-07	4.18E-05	1.51	9.30E-06	7.21E-05
		ECV3AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	7.36	1.04E-01	1.84	2.38E-01	2.31E-01	4.46E-03	3.57E-05	1.34E-02	482.13	2.98E-03	2.31E-02
HDD pull in lift vessel	Jack-up vessel	ECV4T1	Main Engine - In Transit		2,350	4,700	0.25	3.48E-03	0.06	7.71E-03	7.46E-03	3.23E-04	1.12E-06	4.48E-04	16.10	9.95E-05	7.71E-04
		ECV4M1	Main Engine - Maneuvering	2	2,350	4,700	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		ECV4AT1	Auxiliary Engines - Transit		1,000	2,000	0.06	7.68E-04	0.01	1.75E-03	1.70E-03	3.29E-05	2.63E-07	9.87E-05	3.55	2.19E-05	1.70E-04
		ECV4AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	1.28	1.55E-02	0.27	3.54E-02	3.43E-02	6.63E-04	5.31E-06	1.99E-03	71.67	4.42E-04	3.43E-03
Diving support for HDD pull in	Research / Survey	ECV5T1	Main Engine - In Transit		392	784	0.02	3.65E-04	0.00	5.64E-04	5.48E-04	1.10E-04	6.97E-08	4.15E-05	1.06	6.64E-06	5.15E-05
		ECV5M1	Main Engine - Maneuvering	2	392	784	0.20	4.43E-03	0.05	6.85E-03	6.65E-03	1.33E-03	8.47E-07	5.04E-04	12.87	8.06E-05	6.25E-04
		ECV5AT1	Auxiliary Engines - Transit		135	270	0.00	4.15E-05	0.00	9.48E-05	9.18E-05	1.78E-06	1.42E-08	5.33E-06	0.19	1.18E-06	9.18E-06
		ECV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.15	2.09E-03	0.04	4.78E-03	4.63E-03	8.96E-05	7.16E-07	2.69E-04	9.67	5.97E-05	4.63E-04
HDD pull in support vessel	Multipurpose offshore support vessel	ECV6T1	Main Engine - In Transit		1,611	1,611	0.45	1.19E-02	0.11	1.62E-02	1.58E-02	4.06E-03	1.86E-06	1.29E-03	30.32	1.91E-04	1.48E-03
		ECV6M1	Main Engine - Maneuvering	1	1,611	1,611	0.39	1.04E-02	0.09	1.41E-02	1.37E-02	3.52E-03	1.62E-06	1.12E-03	26.30	1.66E-04	1.28E-03
		ECV6AT1	Auxiliary Engines - Transit		123	246	0.04	5.29E-04	0.01	1.21E-03	1.17E-03	2.27E-05	1.81E-07	6.80E-05	2.45	1.51E-05	1.17E-04
		ECV6AM1	Auxiliary Engines - Maneuvering	2	123	246	0.13	1.90E-03	0.03	4.35E-03	4.22E-03	8.16E-05	6.53E-07	2.45E-04	8.81	5.44E-05	4.22E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-22
US Wind, Inc. - Maryland Offshore Wind Project
Met Tower Installation - Annual Emissions - Year 1

Vessel Information												Year 1										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
Met Tower Installation Air Permit Emissions During Construction																						
Met Tower Installation																						
Met Tower installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.83	50	1	50	Sparrows Point	0.74	1.03E-02	0.17	2.28E-02	2.21E-02	9.56E-04	3.31E-06	1.32E-03	47.57	2.94E-04	2.28E-03
		OV1M1	Main Engine - Maneuvering		4,500	22,500	0.00					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.27	50	1	50		0.06	6.70E-04	0.01	1.53E-03	1.48E-03	2.87E-05	2.30E-07	8.61E-05	3.10	1.91E-05	1.48E-04
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	0.45					4.33	5.25E-02	0.93	1.20E-01	1.16E-01	2.25E-03	1.80E-05	6.75E-03	243.08	1.50E-03	1.16E-02
Assisting tug	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.16	3.01E-03	0.04	5.52E-03	5.35E-03	5.52E-04	7.52E-07	3.51E-04	10.76	6.69E-05	5.18E-04
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					1.79	3.39E-02	0.43	6.21E-02	6.02E-02	6.21E-03	8.47E-06	3.95E-03	121.10	7.53E-04	5.83E-03
		OV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	4.75E-05	0.00	1.09E-04	1.05E-04	2.04E-06	1.63E-08	6.11E-06	0.22	1.36E-06	1.05E-05
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.16	2.22E-03	0.04	5.07E-03	4.91E-03	9.51E-05	7.61E-07	2.85E-04	10.27	6.34E-05	4.91E-04
Met Tower PilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.16	3.01E-03	0.04	5.52E-03	5.35E-03	5.52E-04	7.52E-07	3.51E-04	10.76	6.69E-05	5.18E-04
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					1.28	2.42E-02	0.31	4.43E-02	4.30E-02	4.43E-03	6.05E-06	2.82E-03	86.50	5.38E-04	4.17E-03
		OV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	4.75E-05	0.00	1.09E-04	1.05E-04	2.04E-06	1.63E-08	6.11E-06	0.22	1.36E-06	1.05E-05
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.11	1.58E-03	0.03	3.62E-03	3.51E-03	6.79E-05	5.43E-07	2.04E-04	7.34	4.53E-05	3.51E-04
Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.83	50	1	50	Sparrows Point	0.20	3.05E-03	0.05	6.75E-03	6.54E-03	1.31E-04	1.00E-06	3.92E-04	14.12	8.71E-05	6.75E-04
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.2					0.32	4.90E-03	0.08	1.09E-02	1.05E-02	2.10E-04	1.61E-06	6.30E-04	22.70	1.40E-04	1.09E-03
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.27	50	1	50		0.02	2.24E-04	0.00	5.13E-04	4.97E-04	9.62E-06	7.69E-08	2.88E-05	1.04	6.41E-06	4.97E-05
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45					0.19	2.50E-03	0.04	5.70E-03	5.52E-03	1.07E-04	8.55E-07	3.21E-04	11.55	7.13E-05	5.52E-04
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,540	2,500	0.83	50	1	50	Sparrows Point	0.08	1.15E-03	0.02	2.55E-03	2.47E-03	4.94E-05	3.78E-07	1.48E-04	5.33	3.29E-05	2.55E-04
		OV5M1	Main Engine - Maneuvering	2	2,540	2,500	0.2					0.12	1.85E-03	0.03	4.10E-03	3.97E-03	7.94E-05	6.08E-07	2.38E-04	8.57	5.29E-05	4.10E-04
		OV5AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	4.75E-05	0.00	1.09E-04	1.05E-04	2.04E-06	1.63E-08	6.11E-06	0.22	1.36E-06	1.05E-05
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.02	3.17E-04	0.01	7.24E-04	7.02E-04	1.36E-05	1.09E-07	4.07E-05	1.47	9.06E-06	7.02E-05
Met Tower Topside Transport	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.16	3.01E-03	0.04	5.52E-03	5.35E-03	5.52E-04	7.52E-07	3.51E-04	10.76	6.69E-05	5.18E-04
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					0.51	9.68E-03	0.12	1.77E-02	1.72E-02	1.77E-03	2.42E-06	1.13E-03	34.60	2.15E-04	1.67E-03
		OV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	4.75E-05	0.00	1.09E-04	1.05E-04	2.04E-06	1.63E-08	6.11E-06	0.22	1.36E-06	1.05E-05
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.05	6.34E-04	0.01	1.45E-03	1.40E-03	2.72E-05	2.17E-07	8.15E-05	2.93	1.81E-05	1.40E-04
Refueling operations to Met Tower and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.83	50	9	450	Norfolk	0.23	3.45E-03	0.06	7.65E-03	7.40E-03	1.48E-04	1.13E-06	4.44E-04	15.99	9.87E-05	7.65E-04
		OV7M1	Main Engine - Maneuvering	2	749	1,498	0.2					1.31	2.00E-02	0.33	4.42E-02	4.28E-02	8.56E-04	6.56E-06	2.57E-03	92.47	5.71E-04	4.42E-03
		OV7AT1	Auxiliary Engines - Transit		20	40	0.43	50	9	450		0.00	4.78E-05	0.00	1.09E-04	1.06E-04	2.05E-06	1.64E-08	6.14E-06	0.22	1.37E-06	1.06E-05
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.09	1.15E-03	0.02	2.62E-03	2.54E-03	4.91E-05	3.93E-07	1.47E-04	5.31	3.28E-05	2.54E-04
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows Point	0.36	5.02E-03	0.08	1.11E-02	1.08E-02	4.66E-04	1.61E-06	6.45E-04	23.19	1.43E-04	1.11E-03
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.2					1.40	1.96E-02	0.32	4.34E-02	4.20E-02	1.82E-03	6.29E-06	2.52E-03	90.51	5.60E-04	4.34E-03
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		0.09	1.11E-03	0.02	2.53E-03	2.45E-03	4.74E-05	3.79E-07	1.42E-04	5.12	3.16E-05	2.45E-04
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43					1.48	1.79E-02	0.32	4.10E-02	3.97E-02	7.68E-04	6.14E-06	2.30E-03	82.95	5.12E-04	3.97E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-23
US Wind, Inc. - Maryland Offshore Wind Project
Foundation Installation - Annual Emissions - Year 2

Vessel Information							Year 2										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Scour Protection Installation																	
Scour protection installation vessel	Fallpipe vessel	FV1T1	Main Engine - In Transit		4,500	13,500	1.92	5.05E-02	0.44	6.87E-02	6.66E-02	1.72E-02	7.88E-06	5.45E-03	128.24	8.08E-04	6.26E-03
		FV1M1	Main Engine - Maneuvering	3	4,500	13,500	28.65	7.55E-01	6.64	1.03E+00	9.96E-01	2.57E-01	1.18E-04	8.15E-02	1917.43	1.21E-02	9.36E-02
		FV1AT1	Auxiliary Engines - Transit		492	492	0.02	3.35E-04	0.01	7.66E-04	7.42E-04	1.44E-05	1.15E-07	4.31E-05	1.55	9.58E-06	7.42E-05
		FV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	5.97	8.45E-02	1.50	1.93E-01	1.87E-01	3.62E-03	2.90E-05	1.09E-02	391.45	2.42E-03	1.87E-02
Foundation Installation																	
Foundation installation vessel	Heavy lift vessel	FV2T1	Main Engine - In Transit		4,500	22,500	1.34	1.87E-02	0.31	4.14E-02	4.01E-02	1.74E-03	6.02E-06	2.41E-03	86.50	5.35E-04	4.14E-03
		FV2M1	Main Engine - Maneuvering		4,500	22,500	46.41	6.48E-01	10.64	1.43E+00	1.39E+00	6.01E-02	2.08E-04	8.33E-02	2993.80	1.85E-02	1.43E-01
		FV2AT1	Auxiliary Engines - Transit		4500	4500	0.10	1.22E-03	0.02	2.78E-03	2.70E-03	5.22E-05	4.17E-07	1.57E-04	5.64	3.48E-05	2.70E-04
		FV2AM1	Auxiliary Engines - Maneuvering	6	4500	4500	48.09	5.83E-01	10.33	1.33E+00	1.29E+00	2.50E-02	2.00E-04	7.50E-02	2699.08	1.67E-02	1.29E-01
Tug for assisting foundation installation 1 -- Offshore	Tug	FV3T1	Main Engine - In Transit		2,540	5,080	0.65	1.23E-02	0.16	2.26E-02	2.19E-02	2.26E-03	3.08E-06	1.44E-03	44.02	2.74E-04	2.12E-03
		FV3M1	Main Engine - Maneuvering	2	2,540	5,080	9.94	1.88E-01	2.39	3.45E-01	3.34E-01	3.45E-02	4.70E-05	2.19E-02	672.36	4.18E-03	3.24E-02
		FV3AT1	Auxiliary Engines - Transit		199	199	0.01	1.94E-04	0.00	4.44E-04	4.30E-04	8.33E-06	6.66E-08	2.50E-05	0.90	5.55E-06	4.30E-05
		FV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.89	1.23E-02	0.22	2.82E-02	2.73E-02	5.28E-04	4.22E-06	1.58E-03	57.03	3.52E-04	2.73E-03
Foundation transport tug 1	Tug	FV4T1	Main Engine - In Transit		2,540	5,080	1.52	2.87E-02	0.37	5.27E-02	5.11E-02	5.27E-03	7.18E-06	3.35E-03	102.72	6.38E-04	4.95E-03
		FV4M1	Main Engine - Maneuvering	2	2,540	5,080	2.75	5.20E-02	0.66	9.53E-02	9.24E-02	9.53E-03	1.30E-05	6.06E-03	185.78	1.15E-03	8.95E-03
		FV4AT1	Auxiliary Engines - Transit		199	199	0.03	4.53E-04	0.01	1.04E-03	1.00E-03	1.94E-05	1.55E-07	5.83E-05	2.10	1.30E-05	1.00E-04
		FV4AM1	Auxiliary Engines - Maneuvering	1	199	199	0.25	3.40E-03	0.06	7.78E-03	7.54E-03	1.46E-04	1.17E-06	4.38E-04	15.76	9.72E-05	7.54E-04
Foundation transport tug 2	Tug	FV5T1	Main Engine - In Transit		2,540	5,080	1.45	2.74E-02	0.35	5.02E-02	4.86E-02	5.02E-03	6.84E-06	3.19E-03	97.83	6.08E-04	4.71E-03
		FV5M1	Main Engine - Maneuvering	2	2,540	5,080	2.62	4.95E-02	0.63	9.07E-02	8.80E-02	9.07E-03	1.24E-05	5.77E-03	176.94	1.10E-03	8.52E-03
		FV5AT1	Auxiliary Engines - Transit		199	199	0.03	4.32E-04	0.01	9.87E-04	9.56E-04	1.85E-05	1.48E-07	5.55E-05	2.00	1.23E-05	9.56E-05
		FV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.23	3.24E-03	0.06	7.41E-03	7.18E-03	1.39E-04	1.11E-06	4.17E-04	15.01	9.26E-05	7.18E-04
Foundation transport tug 3	Tug	FV6T1	Main Engine - In Transit		2,540	5,080	1.23	2.33E-02	0.30	4.26E-02	4.13E-02	4.26E-03	5.81E-06	2.71E-03	83.15	5.17E-04	4.00E-03
		FV6M1	Main Engine - Maneuvering	2	2,540	5,080	2.22	4.21E-02	0.54	7.71E-02	7.48E-02	7.71E-03	1.05E-05	4.91E-03	150.40	9.35E-04	7.24E-03
		FV6AT1	Auxiliary Engines - Transit		199	199	0.03	3.67E-04	0.01	8.39E-04	8.13E-04	1.57E-05	1.26E-07	4.72E-05	1.70	1.05E-05	8.13E-05
		FV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.20	2.76E-03	0.05	6.30E-03	6.10E-03	1.18E-04	9.45E-07	3.54E-04	12.76	7.87E-05	6.10E-04
Crew transfer vessel 1	Crew transfer vessel	FV7T1	Main Engine - In Transit		749	1,498	0.42	6.47E-03	0.11	1.43E-02	1.39E-02	2.77E-04	2.13E-06	8.32E-04	29.96	1.85E-04	1.43E-03
		FV7M1	Main Engine - Maneuvering	2	749	1,498	0.78	1.20E-02	0.20	2.65E-02	2.57E-02	5.13E-04	3.94E-06	1.54E-03	55.46	3.42E-04	2.65E-03
		FV7AT1	Auxiliary Engines - Transit		20	40	0.01	8.95E-05	0.00	2.05E-04	1.98E-04	3.84E-06	3.07E-08	1.15E-05	0.41	2.56E-06	1.98E-05
		FV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.05	6.88E-04	0.01	1.57E-03	1.52E-03	2.95E-05	2.36E-07	8.84E-05	3.18	1.96E-05	1.52E-04
Noise mitigation vessel	OSV	FV8T1	Main Engine - In Transit		3,310	6,620	1.13	1.73E-02	0.28	3.84E-02	3.72E-02	7.43E-04	5.70E-06	2.23E-03	80.30	4.96E-04	3.84E-03
		FV8M1	Main Engine - Maneuvering	2	3,310	6,620	6.23	9.53E-02	1.57	2.11E-01	2.04E-01	4.08E-03	3.13E-05	1.23E-02	441.16	2.72E-03	2.11E-02
		FV8AT1	Auxiliary Engines - Transit		499	1497	0.09	1.28E-03	0.02	2.92E-03	2.83E-03	5.47E-05	4.37E-07	1.64E-04	5.91	3.65E-05	2.83E-04
		FV8AM1	Auxiliary Engines - Maneuvering	3	499	1497	3.60	4.85E-02	0.86	1.11E-01	1.07E-01	2.08E-03	1.66E-05	6.23E-03	224.47	1.39E-03	1.07E-02
Acoustic monitoring - buoy support vessel	OSV	FV9T1	Main Engine - In Transit		2,540	5,080	0.56	8.51E-03	0.14	1.88E-02	1.82E-02	3.65E-04	2.80E-06	1.09E-03	39.40	2.43E-04	1.88E-03
		FV9M1	Main Engine - Maneuvering	2	2,540	5,080	4.78	7.31E-02	1.20	1.62E-01	1.57E-01	3.13E-03	2.40E-05	9.40E-03	338.53	2.09E-03	1.62E-02
		FV9AT1	Auxiliary Engines - Transit		199	199	0.02	2.25E-04	0.00	5.14E-04	4.98E-04	9.64E-06	7.71E-08	2.89E-05	1.04	6.43E-06	4.98E-05
		FV9AM1	Auxiliary Engines - Maneuvering	1	199	199	0.60	8.02E-03	0.14	1.83E-02	1.78E-02	3.44E-04	2.75E-06	1.03E-03	37.13	2.29E-04	1.78E-03
Marine mammal observation 1	Crew transfer vessel	FV10T1	Main Engine - In Transit		749	1,498	2.12	3.24E-02	0.53	7.17E-02	6.93E-02	1.39E-03	1.06E-05	4.16E-03	149.82	9.25E-04	7.17E-03
		FV10M1	Main Engine - Maneuvering	2	749	1,498	0.94	1.44E-02	0.24	3.18E-02	3.08E-02	6.16E-04	4.72E-06	1.85E-03	66.55	4.11E-04	3.18E-03
		FV10AT1	Auxiliary Engines - Transit		20	40	0.03	4.48E-04	0.01	1.02E-03	9.91E-04	1.92E-05	1.53E-07	5.76E-05	2.07	1.28E-05	9.91E-05
		FV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.06	8.25E-04	0.01	1.89E-03	1.83E-03	3.54E-05	2.83E-07	1.06E-04	3.82	2.36E-05	1.83E-04
Environmental monitoring	Crew transfer vessel	FV11T1	Main Engine - In Transit		749	1,498	2.12	3.24E-02	0.53	7.17E-02	6.93E-02	1.39E-03	1.06E-05	4.16E-03	149.82	9.25E-04	7.17E-03
		FV11M1	Main Engine - Maneuvering	2	749	1,498	0.94	1.44E-02	0.24	3.18E-02	3.08E-02	6.16E-04	4.72E-06	1.85E-03	66.55	4.11E-04	3.18E-03
		FV11AT1	Auxiliary Engines - Transit		20	40	0.03	4.48E-04	0.01	1.02E-03	9.91E-04	1.92E-05	1.53E-07	5.76E-05	2.07	1.28E-05	9.91E-05
		FV11AM1	Auxiliary Engines - Maneuvering	2	20	40	0.06	8.25E-04	0.01	1.89E-03	1.83E-03	3.54E-05	2.83E-07	1.06E-04	3.82	2.36E-05	1.83E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-24
US Wind, Inc. - Maryland Offshore Wind Project
WTG Installation - Annual Emissions - Year 2

Vessel Information							Year 2										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
WTG Installation																	
WTG installation jack-up vessel	Jack-up installation vessel	WV1T1	Main Engine - In Transit	3	3,800	11,400	0.99	1.38E-02	0.23	3.06E-02	2.96E-02	1.28E-03	4.44E-06	1.78E-03	63.91	3.95E-04	3.06E-03
		WV1M1	Main Engine - Maneuvering		3,800	11,400	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		WV1AT1	Auxiliary Engines - Transit	1	2,880	2,880	0.09	1.14E-03	0.02	2.60E-03	2.52E-03	4.87E-05	3.90E-07	1.46E-04	5.26	3.25E-05	2.52E-04
		WV1AM1	Auxiliary Engines - Maneuvering		2,880	2,880	72.00	8.73E-01	15.46	1.99E+00	1.93E+00	3.74E-02	2.99E-04	1.12E-01	4040.73	2.49E-02	1.93E-01
Tug to transport WTG 1	Tug	WV2T1	Main Engine - In Transit	2	2,540	5,080	4.20	7.93E-02	1.01	1.45E-01	1.41E-01	1.45E-02	1.98E-05	9.26E-03	283.70	1.76E-03	1.37E-02
		WV2M1	Main Engine - Maneuvering		2,540	5,080	10.12	1.91E-01	2.43	3.51E-01	3.40E-01	3.51E-02	4.78E-05	2.23E-02	684.16	4.25E-03	3.30E-02
		WV2AT1	Auxiliary Engines - Transit	1	199	199	0.09	1.25E-03	0.02	2.86E-03	2.77E-03	5.37E-05	4.29E-07	1.61E-04	5.80	3.58E-05	2.77E-04
		WV2AM1	Auxiliary Engines - Maneuvering		199	199	0.90	1.25E-02	0.22	2.86E-02	2.78E-02	5.37E-04	4.30E-06	1.61E-03	58.03	3.58E-04	2.78E-03
Tug to transport WTG 2	Tug	WV3T1	Main Engine - In Transit	2	2,540	5,080	4.05	7.66E-02	0.97	1.40E-01	1.36E-01	1.40E-02	1.92E-05	8.94E-03	273.92	1.70E-03	1.32E-02
		WV3M1	Main Engine - Maneuvering		2,540	5,080	9.77	1.85E-01	2.35	3.39E-01	3.28E-01	3.39E-02	4.62E-05	2.16E-02	660.56	4.11E-03	3.18E-02
		WV3AT1	Auxiliary Engines - Transit	1	199	199	0.09	1.21E-03	0.02	2.76E-03	2.68E-03	5.18E-05	4.15E-07	1.55E-04	5.60	3.45E-05	2.68E-04
		WV3AM1	Auxiliary Engines - Maneuvering		199	199	0.87	1.21E-02	0.21	2.77E-02	2.68E-02	5.19E-04	4.15E-06	1.56E-03	56.03	3.46E-04	2.68E-03
Tug to support WTG Installation / maneuvering offshore	Tug	WV4T1	Main Engine - In Transit	2	2,540	5,080	1.16	2.19E-02	0.28	4.01E-02	3.89E-02	4.01E-03	5.47E-06	2.55E-03	78.26	4.86E-04	3.77E-03
		WV4M1	Main Engine - Maneuvering		2,540	5,080	46.52	8.80E-01	11.19	1.61E+00	1.56E+00	1.61E-01	2.20E-04	1.03E-01	3145.54	1.95E-02	1.51E-01
		WV4AT1	Auxiliary Engines - Transit	1	199	199	0.02	3.45E-04	0.01	7.90E-04	7.65E-04	1.48E-05	1.18E-07	4.44E-05	1.60	9.87E-06	7.65E-05
		WV4AM1	Auxiliary Engines - Maneuvering		199	199	4.16	5.76E-02	1.02	1.32E-01	1.28E-01	2.47E-03	1.98E-05	7.41E-03	266.79	1.65E-03	1.28E-02

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-25
US Wind, Inc. - Maryland Offshore Wind Project
WTG Commissioning - Annual Emissions - Year 2

Vessel Information							Year 2										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
WTG Commissioning																	
Crew transfer vessel 1	Crew transfer vessel	CV1T1	Main Engine - In Transit		749	1,498	2.69	4.12E-02	0.68	9.13E-02	8.83E-02	1.77E-03	1.35E-05	5.30E-03	190.83	1.18E-03	9.13E-03
		CV1M1	Main Engine - Maneuvering	2	749	1,498	6.15	9.41E-02	1.55	2.08E-01	2.02E-01	4.03E-03	3.09E-05	1.21E-02	435.50	2.69E-03	2.08E-02
		CV1AT1	Auxiliary Engines - Transit		20	40	0.04	5.70E-04	0.01	1.30E-03	1.26E-03	2.44E-05	1.95E-07	7.33E-05	2.64	1.63E-05	1.26E-04
		CV1AM1	Auxiliary Engines - Maneuvering	2	20	40	0.40	5.40E-03	0.10	1.23E-02	1.20E-02	2.31E-04	1.85E-06	6.94E-04	25.00	1.54E-04	1.20E-03
Crew transfer vessel 2	Crew transfer vessel	CV2T1	Main Engine - In Transit		749	1,498	2.66	4.08E-02	0.67	9.03E-02	8.74E-02	1.75E-03	1.34E-05	5.24E-03	188.72	1.16E-03	9.03E-03
		CV2M1	Main Engine - Maneuvering	2	749	1,498	6.08	9.31E-02	1.53	2.06E-01	1.99E-01	3.99E-03	3.06E-05	1.20E-02	430.83	2.66E-03	2.06E-02
		CV2AT1	Auxiliary Engines - Transit		20	40	0.04	5.64E-04	0.01	1.29E-03	1.25E-03	2.42E-05	1.93E-07	7.25E-05	2.61	1.61E-05	1.25E-04
		CV2AM1	Auxiliary Engines - Maneuvering	2	20	40	0.40	5.34E-03	0.09	1.22E-02	1.18E-02	2.29E-04	1.83E-06	6.87E-04	24.74	1.53E-04	1.18E-03
Crew transfer vessel 3 per GE	Crew transfer vessel	CV3T1	Main Engine - In Transit		749	1,498	1.56	2.38E-02	0.39	5.28E-02	5.11E-02	1.02E-03	7.83E-06	3.07E-03	110.40	6.81E-04	5.28E-03
		CV3M1	Main Engine - Maneuvering	2	749	1,498	3.63	5.55E-02	0.91	1.23E-01	1.19E-01	2.38E-03	1.82E-05	7.13E-03	256.86	1.59E-03	1.23E-02
		CV3AT1	Auxiliary Engines - Transit		20	40	0.02	3.30E-04	0.01	7.54E-04	7.30E-04	1.41E-05	1.13E-07	4.24E-05	1.53	9.42E-06	7.30E-05
		CV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.24	3.19E-03	0.06	7.28E-03	7.05E-03	1.37E-04	1.09E-06	4.10E-04	14.75	9.10E-05	7.05E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-26
US Wind, Inc. - Maryland Offshore Wind Project
OSS Installation - Annual Emissions - Year 2

Vessel Information							Year 2											
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																		
OSS Installation																		
OSS installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	1.34	1.87E-02	0.31	4.14E-02	4.01E-02	1.74E-03	6.02E-06	2.41E-03	86.50	5.35E-04	4.14E-03
		OV1M1	Main Engine - Maneuvering		4,500	22,500	7.60	1.06E-01	1.74	2.35E-01	2.27E-01	9.85E-03	3.41E-05	1.36E-02	490.21	3.03E-03	2.35E-02
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.10	1.22E-03	0.02	2.78E-03	2.70E-03	5.22E-05	4.17E-07	1.57E-04	5.64	3.48E-05	2.70E-04
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	7.88	9.55E-02	1.69	2.18E-01	2.11E-01	4.09E-03	3.27E-05	1.23E-02	441.95	2.73E-03	2.11E-02
Assisting tug for OSS Jacket and topside install	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.29	5.47E-03	0.07	1.00E-02	9.73E-03	1.00E-03	1.37E-06	6.38E-04	19.57	1.22E-04	9.42E-04
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	3.26	6.16E-02	0.78	1.13E-01	1.09E-01	1.13E-02	1.54E-05	7.18E-03	220.19	1.37E-03	1.06E-02
		OV2AT1	Auxiliary Engines - Transit		199	199	0.01	8.64E-05	0.00	1.97E-04	1.91E-04	3.70E-06	2.96E-08	1.11E-05	0.40	2.47E-06	1.91E-05
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.29	4.03E-03	0.07	9.22E-03	8.93E-03	1.73E-04	1.38E-06	5.19E-04	18.68	1.15E-04	8.93E-04
OSS Jacket and pilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.29	5.47E-03	0.07	1.00E-02	9.73E-03	1.00E-03	1.37E-06	6.38E-04	19.57	1.22E-04	9.42E-04
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	2.33	4.40E-02	0.56	8.06E-02	7.82E-02	8.06E-03	1.10E-05	5.13E-03	157.28	9.77E-04	7.57E-03
		OV3AT1	Auxiliary Engines - Transit		199	199	0.01	1.12E-04	0.00	2.57E-04	2.49E-04	4.82E-06	3.86E-08	1.45E-05	0.52	3.21E-06	2.49E-05
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.27	3.75E-03	0.07	8.58E-03	8.31E-03	1.61E-04	1.29E-06	4.82E-04	17.37	1.07E-04	8.31E-04
OSS Jacket Install Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.36	5.55E-03	0.09	1.23E-02	1.19E-02	2.38E-04	1.82E-06	7.13E-04	25.67	1.58E-04	1.23E-03
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.58	8.92E-03	0.15	1.97E-02	1.91E-02	3.82E-04	2.93E-06	1.15E-03	41.28	2.55E-04	1.97E-03
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.03	4.08E-04	0.01	9.32E-04	9.03E-04	1.75E-05	1.40E-07	5.25E-05	1.89	1.17E-05	9.03E-05
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.34	4.54E-03	0.08	1.04E-02	1.00E-02	1.94E-04	1.56E-06	5.83E-04	21.00	1.30E-04	1.00E-03
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,500	2,500	0.14	2.09E-03	0.03	4.64E-03	4.49E-03	8.98E-05	6.88E-07	2.69E-04	9.70	5.98E-05	4.64E-04
		OV5M1	Main Engine - Maneuvering	1	2,500	2,500	0.22	3.37E-03	0.06	7.46E-03	7.22E-03	1.44E-04	1.11E-06	4.33E-04	15.59	9.62E-05	7.46E-04
		OV5AT1	Auxiliary Engines - Transit		199	199	0.01	1.12E-04	0.00	2.57E-04	2.49E-04	4.82E-06	3.86E-08	1.45E-05	0.52	3.21E-06	2.49E-05
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.06	7.50E-04	0.01	1.72E-03	1.66E-03	3.22E-05	2.57E-07	9.65E-05	3.47	2.14E-05	1.66E-04
OSS Topside Transport (assume separate from Jacket/piles)	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.29	5.47E-03	0.07	1.00E-02	9.73E-03	1.00E-03	1.37E-06	6.38E-04	19.57	1.22E-04	9.42E-04
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.93	1.76E-02	0.22	3.23E-02	3.13E-02	3.23E-03	4.40E-06	2.05E-03	62.91	3.91E-04	3.03E-03
		OV6AT1	Auxiliary Engines - Transit		199	199	0.01	8.64E-05	0.00	1.97E-04	1.91E-04	3.70E-06	2.96E-08	1.11E-05	0.40	2.47E-06	1.91E-05
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.08	1.15E-03	0.02	2.63E-03	2.55E-03	4.94E-05	3.95E-07	1.48E-04	5.34	3.29E-05	2.55E-04
Refueling operations to OSS and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.41	6.28E-03	0.10	1.39E-02	1.35E-02	2.69E-04	2.06E-06	8.07E-04	29.07	1.79E-04	1.39E-03
		OV7M1	Main Engine - Maneuvering	2	749	1,498	2.37	3.63E-02	0.60	8.04E-02	7.78E-02	1.56E-03	1.19E-05	4.67E-03	168.13	1.04E-03	8.04E-03
		OV7AT1	Auxiliary Engines - Transit		20	40	0.01	1.13E-04	0.00	2.59E-04	2.51E-04	4.85E-06	3.88E-08	1.45E-05	0.52	3.23E-06	2.51E-05
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.20	2.72E-03	0.05	6.21E-03	6.01E-03	1.16E-04	9.31E-07	3.49E-04	12.57	7.76E-05	6.01E-04
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.65	9.12E-03	0.15	2.02E-02	1.95E-02	8.47E-04	2.93E-06	1.17E-03	42.16	2.61E-04	2.02E-03
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	2.55	3.56E-02	0.58	7.88E-02	7.63E-02	3.31E-03	1.14E-05	4.58E-03	164.57	1.02E-03	7.88E-03
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.17	2.01E-03	0.04	4.60E-03	4.45E-03	8.62E-05	6.89E-07	2.59E-04	9.31	5.75E-05	4.45E-04
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	2.69	3.26E-02	0.58	7.45E-02	7.21E-02	1.40E-03	1.12E-05	4.19E-03	150.83	9.31E-04	7.21E-03
OSS emergency generators	150 kW standard diesel generator	OD1	Engine	4	150	600	0.26	1.26E-01	2.31	1.98E-02	1.98E-02	4.50E-03	0.00E+00	1.16E-02	489.15	1.98E-02	3.97E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-27
US Wind, Inc. - Maryland Offshore Wind Project
Inter-Array Cable Installation - Annual Emissions - Year 2

Vessel Information							Year 2										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Inter-Array Cable Installation																	
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	IV1T1	Main Engine - In Transit		1,750	5,250	0.89	2.34E-02	0.21	3.18E-02	3.09E-02	7.95E-03	3.65E-06	2.53E-03	59.42	3.74E-04	2.90E-03
		IV1M1	Main Engine - Maneuvering		1,750	5,250	15.61	4.11E-01	3.62	5.59E-01	5.43E-01	1.40E-01	6.42E-05	4.44E-02	1044.62	6.58E-03	5.10E-02
		IV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.21	2.95E-03	0.05	6.73E-03	6.52E-03	1.26E-04	1.01E-06	3.79E-04	13.64	8.42E-05	6.52E-04
		IV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	15.18	2.15E-01	3.81	4.91E-01	4.76E-01	9.21E-03	7.37E-05	2.76E-02	995.22	6.14E-03	4.76E-02
Pre-lay grapnel run	Multipurpose offshore support vessel	IV2T1	Main Engine - In Transit		1611	1611	0.10	1.81E-03	0.02	3.32E-03	3.22E-03	3.32E-04	4.52E-07	2.11E-04	6.47	4.02E-05	3.12E-04
		IV2M1	Main Engine - Maneuvering	1	1611	1611	0.42	7.95E-03	0.10	1.46E-02	1.41E-02	1.46E-03	1.99E-06	9.28E-04	28.43	1.77E-04	1.37E-03
		IV2AT1	Auxiliary Engines - Transit		123	246	0.01	1.11E-04	0.00	2.54E-04	2.46E-04	4.77E-06	3.82E-08	1.43E-05	0.52	3.18E-06	2.46E-05
		IV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.15	2.03E-03	0.04	4.64E-03	4.50E-03	8.70E-05	6.96E-07	2.61E-04	9.40	5.80E-05	4.50E-04
Crew transfer vessel 1	Crew transfer vessel	IV3T1	Main Engine - In Transit		749	1,498	2.23	3.41E-02	0.56	7.54E-02	7.30E-02	1.46E-03	1.12E-05	4.38E-03	157.71	9.73E-04	7.54E-03
		IV3M1	Main Engine - Maneuvering	2	749	1,498	4.94	7.57E-02	1.24	1.68E-01	1.62E-01	3.24E-03	2.49E-05	9.73E-03	350.27	2.16E-03	1.68E-02
		IV3AT1	Auxiliary Engines - Transit		20	40	0.03	4.71E-04	0.01	1.08E-03	1.04E-03	2.02E-05	1.62E-07	6.06E-05	2.18	1.35E-05	1.04E-04
		IV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.32	4.34E-03	0.08	9.93E-03	9.62E-03	1.86E-04	1.49E-06	5.58E-04	20.11	1.24E-04	9.62E-04
Crew transfer vessel 2	Crew transfer vessel	IV4T1	Main Engine - In Transit		749	1,498	2.23	3.41E-02	0.56	7.54E-02	7.30E-02	1.46E-03	1.12E-05	4.38E-03	157.71	9.73E-04	7.54E-03
		IV4M1	Main Engine - Maneuvering	2	749	1,498	4.94	7.57E-02	1.24	1.68E-01	1.62E-01	3.24E-03	2.49E-05	9.73E-03	350.27	2.16E-03	1.68E-02
		IV4AT1	Auxiliary Engines - Transit		20	40	0.03	4.71E-04	0.01	1.08E-03	1.04E-03	2.02E-05	1.62E-07	6.06E-05	2.18	1.35E-05	1.04E-04
		IV4AM1	Auxiliary Engines - Maneuvering	2	20	40	0.32	4.34E-03	0.08	9.93E-03	9.62E-03	1.86E-04	1.49E-06	5.58E-04	20.11	1.24E-04	9.62E-04
Trenching vessel	Purpose-built offshore construction/ROV/surve y vessel	IV5T1	Main Engine - In Transit		3,000	15,000	0.89	2.34E-02	0.21	3.18E-02	3.09E-02	7.95E-03	3.65E-06	2.53E-03	59.42	3.74E-04	2.90E-03
		IV5M1	Main Engine - Maneuvering		3,000	15,000	44.51	1.17E+00	10.32	1.59E+00	1.55E+00	3.99E-01	1.83E-04	1.27E-01	2978.09	1.88E-02	1.45E-01
		IV5AT1	Auxiliary Engines - Transit		3,000	3,000	0.06	8.52E-04	0.02	1.95E-03	1.89E-03	3.65E-05	2.92E-07	1.10E-04	3.95	2.44E-05	1.89E-04
		IV5AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	20.87	2.95E-01	5.23	6.75E-01	6.54E-01	1.27E-02	1.01E-04	3.80E-02	1367.95	8.44E-03	6.54E-02
Guard vessel	Crew transfer vessel	IV6T1	Main Engine - In Transit		749	1,498	0.14	2.10E-03	0.03	4.66E-03	4.51E-03	9.01E-05	6.91E-07	2.70E-04	9.74	6.01E-05	4.66E-04
		IV6M1	Main Engine - Maneuvering	2	749	1,498	0.99	1.51E-02	0.25	3.35E-02	3.24E-02	6.48E-04	4.97E-06	1.95E-03	70.05	4.32E-04	3.35E-03
		IV6AT1	Auxiliary Engines - Transit		20	40	0.00	2.91E-05	0.00	6.65E-05	6.44E-05	1.25E-06	9.97E-09	3.74E-06	0.13	8.31E-07	6.44E-06
		IV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.06	8.69E-04	0.02	1.99E-03	1.92E-03	3.72E-05	2.98E-07	1.12E-04	4.02	2.48E-05	1.92E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-28
US Wind, Inc. - Maryland Offshore Wind Project
Offshore Export Cable Installation - Annual Emissions - Year 2

Vessel Information							Year 2										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Offshore Export Cable Installation																	
Offshore export cable pre-lay survey, trenching, cable lay and pull	Cable lay vessel	ECV1T1	Main Engine - In Transit		1,750	5,250	0.30	7.80E-03	0.07	1.06E-02	1.03E-02	2.65E-03	1.22E-06	8.42E-04	19.81	1.25E-04	9.67E-04
		ECV1M1	Main Engine - Maneuvering		1,750	5,250	14.38	3.79E-01	3.33	5.15E-01	5.00E-01	1.29E-01	5.91E-05	4.09E-02	962.15	6.06E-03	4.70E-02
		ECV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.07	9.82E-04	0.02	2.24E-03	2.17E-03	4.21E-05	3.37E-07	1.26E-04	4.55	2.81E-05	2.17E-04
		ECV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	13.99	1.98E-01	3.51	4.53E-01	4.38E-01	8.48E-03	6.79E-05	2.55E-02	916.65	5.66E-03	4.38E-02
Pre-lay grapnel run & pre-lay survey; post lay survey after completion	Multipurpose offshore support vessel	ECV2T1	Main Engine - In Transit		1,611	1,611	0.19	5.02E-03	0.04	6.83E-03	6.63E-03	1.71E-03	7.84E-07	5.43E-04	12.76	8.04E-05	6.23E-04
		ECV2M1	Main Engine - Maneuvering	1	1,611	1,611	1.47	3.87E-02	0.34	5.27E-02	5.11E-02	1.32E-02	6.04E-06	4.18E-03	98.41	6.20E-04	4.80E-03
		ECV2AT1	Auxiliary Engines - Transit		123	246	0.02	2.23E-04	0.00	5.09E-04	4.93E-04	9.54E-06	7.63E-08	2.86E-05	1.03	6.36E-06	4.93E-05
		ECV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.50	7.12E-03	0.13	1.63E-02	1.58E-02	3.05E-04	2.44E-06	9.16E-04	32.98	2.04E-04	1.58E-03
Trenching vessel	Purpose built offshore construction/survey vessel	ECV3T1	Main Engine - In Transit		3,000	15,000	0.89	2.34E-02	0.21	3.18E-02	3.09E-02	7.95E-03	3.65E-06	2.53E-03	59.42	3.74E-04	2.90E-03
		ECV3M1	Main Engine - Maneuvering		3,000	15,000	41.08	1.08E+00	9.52	1.47E+00	1.43E+00	3.68E-01	1.69E-04	1.17E-01	2749.00	1.73E-02	1.34E-01
		ECV3AT1	Auxiliary Engines - Transit		3,000	3,000	0.06	8.52E-04	0.02	1.95E-03	1.89E-03	3.65E-05	2.92E-07	1.10E-04	3.95	2.44E-05	1.89E-04
		ECV3AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	19.27	2.73E-01	4.83	6.23E-01	6.04E-01	1.17E-02	9.35E-05	3.51E-02	1262.73	7.79E-03	6.04E-02
HDD pull in lift vessel	Jack-up vessel	ECV4T1	Main Engine - In Transit		2,350	4,700	0.65	9.12E-03	0.15	2.02E-02	1.95E-02	8.47E-04	2.93E-06	1.17E-03	42.16	2.61E-04	2.02E-03
		ECV4M1	Main Engine - Maneuvering	2	2,350	4,700	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		ECV4AT1	Auxiliary Engines - Transit		1,000	2,000	0.17	2.01E-03	0.04	4.60E-03	4.45E-03	8.62E-05	6.89E-07	2.59E-04	9.31	5.75E-05	4.45E-04
		ECV4AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	3.34	4.05E-02	0.72	9.27E-02	8.98E-02	1.74E-03	1.39E-05	5.21E-03	187.69	1.16E-03	8.98E-03
Diving support for HDD pull in	Research / Survey	ECV5T1	Main Engine - In Transit		392	784	0.04	9.56E-04	0.01	1.48E-03	1.43E-03	2.87E-04	1.83E-07	1.09E-04	2.77	1.74E-05	1.35E-04
		ECV5M1	Main Engine - Maneuvering	2	392	784	0.52	1.16E-02	0.12	1.80E-02	1.74E-02	3.48E-03	2.22E-06	1.32E-03	33.70	2.11E-04	1.64E-03
		ECV5AT1	Auxiliary Engines - Transit		135	270	0.01	1.09E-04	0.00	2.48E-04	2.40E-04	4.65E-06	3.72E-08	1.40E-05	0.50	3.10E-06	2.40E-05
		ECV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.40	5.47E-03	0.10	1.25E-02	1.21E-02	2.35E-04	1.88E-06	7.04E-04	25.34	1.56E-04	1.21E-03
HDD pull in support vessel	Multipurpose offshore support vessel	ECV6T1	Main Engine - In Transit		1,611	1,611	1.19	3.13E-02	0.28	4.25E-02	4.13E-02	1.06E-02	4.88E-06	3.38E-03	79.41	5.00E-04	3.88E-03
		ECV6M1	Main Engine - Maneuvering	1	1,611	1,611	1.03	2.71E-02	0.24	3.69E-02	3.58E-02	9.22E-03	4.23E-06	2.93E-03	68.89	4.34E-04	3.36E-03
		ECV6AT1	Auxiliary Engines - Transit		123	246	0.10	1.39E-03	0.02	3.17E-03	3.07E-03	5.94E-05	4.75E-07	1.78E-04	6.41	3.96E-05	3.07E-04
		ECV6AM1	Auxiliary Engines - Maneuvering	2	123	246	0.35	4.99E-03	0.09	1.14E-02	1.10E-02	2.14E-04	1.71E-06	6.41E-04	23.09	1.42E-04	1.10E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-29
US Wind, Inc. - Maryland Offshore Wind Project
Met Tower Installation - Annual Emissions - Year 2

Vessel Information												Year 2										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
Met Tower Installation Air Permit Emissions During Construction																						
Met Tower Installation																						
Met Tower installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1M1	Main Engine - Maneuvering		4,500	22,500	0.00					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.27	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	0.45					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Assisting tug	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Met Tower PilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.27	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,540	2,500	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV5M1	Main Engine - Maneuvering	2	2,540	2,500	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV5AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Met Tower Topside Transport	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Refueling operations to Met Tower and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.83	50	9	450	Norfolk	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV7M1	Main Engine - Maneuvering	2	749	1,498	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV7AT1	Auxiliary Engines - Transit		20	40	0.43	50	9	450		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-30
US Wind, Inc. - Maryland Offshore Wind Project
Foundation Installation - Annual Emissions - Year 3

Vessel Information							Year 3										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Scour Protection Installation																	
Scour protection installation vessel	Fallpipe vessel	FV1T1	Main Engine - In Transit		4,500	13,500	1.57	4.13E-02	0.36	5.62E-02	5.45E-02	1.40E-02	6.44E-06	4.46E-03	104.92	6.61E-04	5.12E-03
		FV1M1	Main Engine - Maneuvering	3	4,500	13,500	23.44	6.18E-01	5.44	8.40E-01	8.15E-01	2.10E-01	9.63E-05	6.67E-02	1568.81	9.88E-03	7.66E-02
		FV1AT1	Auxiliary Engines - Transit		492	492	0.02	2.74E-04	0.00	6.27E-04	6.07E-04	1.18E-05	9.40E-08	3.53E-05	1.27	7.84E-06	6.07E-05
		FV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	4.89	6.92E-02	1.23	1.58E-01	1.53E-01	2.96E-03	2.37E-05	8.89E-03	320.27	1.98E-03	1.53E-02
Foundation Installation																	
Foundation installation vessel	Heavy lift vessel	FV2T1	Main Engine - In Transit		4,500	22,500	1.10	1.53E-02	0.25	3.39E-02	3.28E-02	1.42E-03	4.92E-06	1.97E-03	70.77	4.37E-04	3.39E-03
		FV2M1	Main Engine - Maneuvering		4,500	22,500	37.97	5.30E-01	8.71	1.17E+00	1.14E+00	4.92E-02	1.70E-04	6.81E-02	2449.47	1.51E-02	1.17E-01
		FV2AT1	Auxiliary Engines - Transit		4500	4500	0.08	9.96E-04	0.02	2.28E-03	2.21E-03	4.27E-05	3.42E-07	1.28E-04	4.61	2.85E-05	2.21E-04
		FV2AM1	Auxiliary Engines - Maneuvering	6	4500	4500	39.35	4.77E-01	8.45	1.09E+00	1.06E+00	2.04E-02	1.64E-04	6.13E-02	2208.34	1.36E-02	1.06E-01
Tug for assisting foundation installation 1 -- Offshore	Tug	FV3T1	Main Engine - In Transit		2,540	5,080	0.53	1.01E-02	0.13	1.85E-02	1.79E-02	1.85E-03	2.52E-06	1.18E-03	36.02	2.24E-04	1.73E-03
		FV3M1	Main Engine - Maneuvering	2	2,540	5,080	8.14	1.54E-01	1.96	2.82E-01	2.73E-01	2.82E-02	3.85E-05	1.79E-02	550.11	3.42E-03	2.65E-02
		FV3AT1	Auxiliary Engines - Transit		199	199	0.01	1.59E-04	0.00	3.63E-04	3.52E-04	6.81E-06	5.45E-08	2.04E-05	0.74	4.54E-06	3.52E-05
		FV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.73	1.01E-02	0.18	2.30E-02	2.23E-02	4.32E-04	3.46E-06	1.30E-03	46.66	2.88E-04	2.23E-03
Foundation transport tug 1	Tug	FV4T1	Main Engine - In Transit		2,540	5,080	1.24	2.35E-02	0.30	4.31E-02	4.18E-02	4.31E-03	5.88E-06	2.74E-03	84.04	5.22E-04	4.05E-03
		FV4M1	Main Engine - Maneuvering	2	2,540	5,080	2.25	4.25E-02	0.54	7.79E-02	7.56E-02	7.79E-03	1.06E-05	4.96E-03	152.00	9.45E-04	7.32E-03
		FV4AT1	Auxiliary Engines - Transit		199	199	0.03	3.71E-04	0.01	8.48E-04	8.21E-04	1.59E-05	1.27E-07	4.77E-05	1.72	1.06E-05	8.21E-05
		FV4AM1	Auxiliary Engines - Maneuvering	1	199	199	0.20	2.78E-03	0.05	6.36E-03	6.17E-03	1.19E-04	9.55E-07	3.58E-04	12.89	7.96E-05	6.17E-04
Foundation transport tug 2	Tug	FV5T1	Main Engine - In Transit		2,540	5,080	1.18	2.24E-02	0.28	4.10E-02	3.98E-02	4.10E-03	5.60E-06	2.61E-03	80.04	4.97E-04	3.85E-03
		FV5M1	Main Engine - Maneuvering	2	2,540	5,080	2.14	4.05E-02	0.52	7.42E-02	7.20E-02	7.42E-03	1.01E-05	4.72E-03	144.77	9.00E-04	6.97E-03
		FV5AT1	Auxiliary Engines - Transit		199	199	0.03	3.53E-04	0.01	8.08E-04	7.82E-04	1.51E-05	1.21E-07	4.54E-05	1.64	1.01E-05	7.82E-05
		FV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.19	2.65E-03	0.05	6.06E-03	5.87E-03	1.14E-04	9.09E-07	3.41E-04	12.28	7.58E-05	5.87E-04
Foundation transport tug 3	Tug	FV6T1	Main Engine - In Transit		2,540	5,080	1.01	1.90E-02	0.24	3.49E-02	3.38E-02	3.49E-03	4.76E-06	2.22E-03	68.03	4.23E-04	3.28E-03
		FV6M1	Main Engine - Maneuvering	2	2,540	5,080	1.82	3.44E-02	0.44	6.31E-02	6.12E-02	6.31E-03	8.60E-06	4.01E-03	123.05	7.65E-04	5.93E-03
		FV6AT1	Auxiliary Engines - Transit		199	199	0.02	3.00E-04	0.01	6.86E-04	6.65E-04	1.29E-05	1.03E-07	3.86E-05	1.39	8.58E-06	6.65E-05
		FV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.16	2.25E-03	0.04	5.15E-03	4.99E-03	9.66E-05	7.73E-07	2.90E-04	10.44	6.44E-05	4.99E-04
Crew transfer vessel 1	Crew transfer vessel	FV7T1	Main Engine - In Transit		749	1,498	0.35	5.30E-03	0.09	1.17E-02	1.13E-02	2.27E-04	1.74E-06	6.81E-04	24.52	1.51E-04	1.17E-03
		FV7M1	Main Engine - Maneuvering	2	749	1,498	0.64	9.80E-03	0.16	2.17E-02	2.10E-02	4.20E-04	3.22E-06	1.26E-03	45.38	2.80E-04	2.17E-03
		FV7AT1	Auxiliary Engines - Transit		20	40	0.01	7.33E-05	0.00	1.67E-04	1.62E-04	3.14E-06	2.51E-08	9.42E-06	0.34	2.09E-06	1.62E-05
		FV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.04	5.63E-04	0.01	1.29E-03	1.25E-03	2.41E-05	1.93E-07	7.23E-05	2.61	1.61E-05	1.25E-04
Noise mitigation vessel	OSV	FV8T1	Main Engine - In Transit		3,310	6,620	0.93	1.42E-02	0.23	3.14E-02	3.04E-02	6.08E-04	4.66E-06	1.82E-03	65.70	4.05E-04	3.14E-03
		FV8M1	Main Engine - Maneuvering	2	3,310	6,620	5.10	7.80E-02	1.28	1.73E-01	1.67E-01	3.34E-03	2.56E-05	1.00E-02	360.95	2.23E-03	1.73E-02
		FV8AT1	Auxiliary Engines - Transit		499	1497	0.08	1.04E-03	0.02	2.39E-03	2.31E-03	4.47E-05	3.58E-07	1.34E-04	4.83	2.98E-05	2.31E-04
		FV8AM1	Auxiliary Engines - Maneuvering	3	499	1497	2.94	3.97E-02	0.70	9.07E-02	8.78E-02	1.70E-03	1.36E-05	5.10E-03	183.66	1.13E-03	8.78E-03
Acoustic monitoring - buoy support vessel	OSV	FV9T1	Main Engine - In Transit		2,540	5,080	0.46	6.96E-03	0.11	1.54E-02	1.49E-02	2.98E-04	2.29E-06	8.95E-04	32.24	1.99E-04	1.54E-03
		FV9M1	Main Engine - Maneuvering	2	2,540	5,080	3.91	5.98E-02	0.98	1.32E-01	1.28E-01	2.56E-03	1.97E-05	7.69E-03	276.98	1.71E-03	1.32E-02
		FV9AT1	Auxiliary Engines - Transit		199	199	0.01	1.84E-04	0.00	4.21E-04	4.08E-04	7.89E-06	6.31E-08	2.37E-05	0.85	5.26E-06	4.08E-05
		FV9AM1	Auxiliary Engines - Maneuvering	1	199	199	0.49	6.56E-03	0.12	1.50E-02	1.45E-02	2.81E-04	2.25E-06	8.44E-04	30.38	1.87E-04	1.45E-03
Marine mammal observation 1	Crew transfer vessel	FV10T1	Main Engine - In Transit		749	1,498	1.73	2.65E-02	0.43	5.86E-02	5.67E-02	1.13E-03	8.70E-06	3.40E-03	122.58	7.56E-04	5.86E-03
		FV10M1	Main Engine - Maneuvering	2	749	1,498	0.77	1.18E-02	0.19	2.60E-02	2.52E-02	5.04E-04	3.86E-06	1.51E-03	54.45	3.36E-04	2.60E-03
		FV10AT1	Auxiliary Engines - Transit		20	40	0.03	3.66E-04	0.01	8.37E-04	8.11E-04	1.57E-05	1.26E-07	4.71E-05	1.70	1.05E-05	8.11E-05
		FV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.05	6.75E-04	0.01	1.54E-03	1.50E-03	2.89E-05	2.31E-07	8.68E-05	3.13	1.93E-05	1.50E-04
Environmental monitoring	Crew transfer vessel	FV11T1	Main Engine - In Transit		749	1,498	1.73	2.65E-02	0.43	5.86E-02	5.67E-02	1.13E-03	8.70E-06	3.40E-03	122.58	7.56E-04	5.86E-03
		FV11M1	Main Engine - Maneuvering	2	749	1,498	0.77	1.18E-02	0.19	2.60E-02	2.52E-02	5.04E-04	3.86E-06	1.51E-03	54.45	3.36E-04	2.60E-03
		FV11AT1	Auxiliary Engines - Transit		20	40	0.03	3.66E-04	0.01	8.37E-04	8.11E-04	1.57E-05	1.26E-07	4.71E-05	1.70	1.05E-05	8.11E-05
		FV11AM1	Auxiliary Engines - Maneuvering	2	20	40	0.05	6.75E-04	0.01	1.54E-03	1.50E-03	2.89E-05	2.31E-07	8.68E-05	3.13	1.93E-05	1.50E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-31
US Wind, Inc. - Maryland Offshore Wind Project
WTG Installation - Annual Emissions - Year 3

Vessel Information							Year 3										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
WTG Installation																	
WTG installation jack-up vessel	Jack-up installation vessel	WV1T1	Main Engine - In Transit	3	3,800	11,400	0.81	1.13E-02	0.19	2.51E-02	2.42E-02	1.05E-03	3.64E-06	1.45E-03	52.29	3.23E-04	2.51E-03
		WV1M1	Main Engine - Maneuvering		3,800	11,400	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		WV1AT1	Auxiliary Engines - Transit	1	2,880	2,880	0.08	9.30E-04	0.02	2.13E-03	2.06E-03	3.98E-05	3.19E-07	1.20E-04	4.30	2.66E-05	2.06E-04
		WV1AM1	Auxiliary Engines - Maneuvering		2,880	2,880	58.91	7.14E-01	12.65	1.63E+00	1.58E+00	3.06E-02	2.45E-04	9.18E-02	3306.05	2.04E-02	1.58E-01
Tug to transport WTG 1	Tug	WV2T1	Main Engine - In Transit	2	2,540	5,080	3.43	6.49E-02	0.83	1.19E-01	1.15E-01	1.19E-02	1.62E-05	7.57E-03	232.12	1.44E-03	1.12E-02
		WV2M1	Main Engine - Maneuvering		2,540	5,080	8.28	1.57E-01	1.99	2.87E-01	2.78E-01	2.87E-02	3.91E-05	1.83E-02	559.76	3.48E-03	2.70E-02
		WV2AT1	Auxiliary Engines - Transit	1	199	199	0.07	1.02E-03	0.02	2.34E-03	2.27E-03	4.39E-05	3.51E-07	1.32E-04	4.74	2.93E-05	2.27E-04
		WV2AM1	Auxiliary Engines - Maneuvering		199	199	0.74	1.03E-02	0.18	2.34E-02	2.27E-02	4.39E-04	3.52E-06	1.32E-03	47.48	2.93E-04	2.27E-03
Tug to transport WTG 2	Tug	WV3T1	Main Engine - In Transit	2	2,540	5,080	3.31	6.27E-02	0.80	1.15E-01	1.11E-01	1.15E-02	1.57E-05	7.31E-03	224.11	1.39E-03	1.08E-02
		WV3M1	Main Engine - Maneuvering		2,540	5,080	7.99	1.51E-01	1.92	2.77E-01	2.69E-01	2.77E-02	3.78E-05	1.76E-02	540.46	3.36E-03	2.60E-02
		WV3AT1	Auxiliary Engines - Transit	1	199	199	0.07	9.89E-04	0.02	2.26E-03	2.19E-03	4.24E-05	3.39E-07	1.27E-04	4.58	2.83E-05	2.19E-04
		WV3AM1	Auxiliary Engines - Maneuvering		199	199	0.71	9.90E-03	0.18	2.26E-02	2.19E-02	4.24E-04	3.39E-06	1.27E-03	45.84	2.83E-04	2.19E-03
Tug to support WTG Installation / maneuvering offshore	Tug	WV4T1	Main Engine - In Transit	2	2,540	5,080	0.95	1.79E-02	0.23	3.28E-02	3.18E-02	3.28E-03	4.48E-06	2.09E-03	64.03	3.98E-04	3.08E-03
		WV4M1	Main Engine - Maneuvering		2,540	5,080	38.07	7.20E-01	9.16	1.32E+00	1.28E+00	1.32E-01	1.80E-04	8.40E-02	2573.63	1.60E-02	1.24E-01
		WV4AT1	Auxiliary Engines - Transit	1	199	199	0.02	2.83E-04	0.01	6.46E-04	6.26E-04	1.21E-05	9.69E-08	3.63E-05	1.31	8.08E-06	6.26E-05
		WV4AM1	Auxiliary Engines - Maneuvering		199	199	3.40	4.71E-02	0.84	1.08E-01	1.04E-01	2.02E-03	1.62E-05	6.06E-03	218.29	1.35E-03	1.04E-02

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-32
US Wind, Inc. - Maryland Offshore Wind Project
WTG Commissioning - Annual Emissions - Year 3

Vessel Information							Year 3										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
WTG Commissioning																	
Crew transfer vessel 1	Crew transfer vessel	CV1T1	Main Engine - In Transit	2	749	1,498	2.20	3.37E-02	0.55	7.47E-02	7.23E-02	1.45E-03	1.11E-05	4.34E-03	156.13	9.64E-04	7.47E-03
		CV1M1	Main Engine - Maneuvering		749	1,498	5.03	7.70E-02	1.26	1.70E-01	1.65E-01	3.30E-03	2.53E-05	9.90E-03	356.32	2.20E-03	1.70E-02
		CV1AT1	Auxiliary Engines - Transit	2	20	40	0.03	4.67E-04	0.01	1.07E-03	1.03E-03	2.00E-05	1.60E-07	6.00E-05	2.16	1.33E-05	1.03E-04
		CV1AM1	Auxiliary Engines - Maneuvering		20	40	0.33	4.42E-03	0.08	1.01E-02	9.78E-03	1.89E-04	1.51E-06	5.68E-04	20.46	1.26E-04	9.78E-04
Crew transfer vessel 2	Crew transfer vessel	CV2T1	Main Engine - In Transit	2	749	1,498	2.18	3.34E-02	0.55	7.39E-02	7.15E-02	1.43E-03	1.10E-05	4.29E-03	154.41	9.53E-04	7.39E-03
		CV2M1	Main Engine - Maneuvering		749	1,498	4.98	7.61E-02	1.25	1.69E-01	1.63E-01	3.26E-03	2.50E-05	9.79E-03	352.50	2.18E-03	1.69E-02
		CV2AT1	Auxiliary Engines - Transit	2	20	40	0.03	4.61E-04	0.01	1.05E-03	1.02E-03	1.98E-05	1.58E-07	5.93E-05	2.14	1.32E-05	1.02E-04
		CV2AM1	Auxiliary Engines - Maneuvering		20	40	0.32	4.37E-03	0.08	9.99E-03	9.68E-03	1.87E-04	1.50E-06	5.62E-04	20.24	1.25E-04	9.68E-04
Crew transfer vessel 3 per GE	Crew transfer vessel	CV3T1	Main Engine - In Transit	2	749	1,498	1.28	1.95E-02	0.32	4.32E-02	4.18E-02	8.36E-04	6.41E-06	2.51E-03	90.32	5.57E-04	4.32E-03
		CV3M1	Main Engine - Maneuvering		749	1,498	2.97	4.54E-02	0.75	1.01E-01	9.73E-02	1.95E-03	1.49E-05	5.84E-03	210.16	1.30E-03	1.01E-02
		CV3AT1	Auxiliary Engines - Transit	2	20	40	0.02	2.70E-04	0.00	6.17E-04	5.98E-04	1.16E-05	9.25E-08	3.47E-05	1.25	7.71E-06	5.98E-05
		CV3AM1	Auxiliary Engines - Maneuvering		20	40	0.19	2.61E-03	0.05	5.96E-03	5.77E-03	1.12E-04	8.94E-07	3.35E-04	12.07	7.45E-05	5.77E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-33
US Wind, Inc. - Maryland Offshore Wind Project
OSS Installation - Annual Emissions - Year 3

Vessel Information							Year 3										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
OSS Installation																	
OSS installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	1.10	1.53E-02	0.25	3.39E-02	3.28E-02	1.42E-03	4.92E-06	1.97E-03	70.77	4.37E-04	3.39E-03
		OV1M1	Main Engine - Maneuvering		4,500	22,500	6.22	8.68E-02	1.43	1.92E-01	1.86E-01	8.06E-03	2.79E-05	1.12E-02	401.08	2.48E-03	1.92E-02
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.08	9.96E-04	0.02	2.28E-03	2.21E-03	4.27E-05	3.42E-07	1.28E-04	4.61	2.85E-05	2.21E-04
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	6.44	7.81E-02	1.38	1.79E-01	1.73E-01	3.35E-03	2.68E-05	1.00E-02	361.60	2.23E-03	1.73E-02
Assisting tug for OSS Jacket and topside install	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.24	4.48E-03	0.06	8.21E-03	7.96E-03	8.21E-04	1.12E-06	5.22E-04	16.01	9.95E-05	7.71E-04
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	2.66	5.04E-02	0.64	9.24E-02	8.96E-02	9.24E-03	1.26E-05	5.88E-03	180.15	1.12E-03	8.68E-03
		OV2AT1	Auxiliary Engines - Transit		199	199	0.01	7.07E-05	0.00	1.62E-04	1.56E-04	3.03E-06	2.42E-08	9.09E-06	0.33	2.02E-06	1.56E-05
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.24	3.30E-03	0.06	7.54E-03	7.31E-03	1.41E-04	1.13E-06	4.24E-04	15.28	9.43E-05	7.31E-04
OSS Jacket and pilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.24	4.48E-03	0.06	8.21E-03	7.96E-03	8.21E-04	1.12E-06	5.22E-04	16.01	9.95E-05	7.71E-04
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	1.90	3.60E-02	0.46	6.60E-02	6.40E-02	6.60E-03	9.00E-06	4.20E-03	128.68	8.00E-04	6.20E-03
		OV3AT1	Auxiliary Engines - Transit		199	199	0.01	9.20E-05	0.00	2.10E-04	2.04E-04	3.94E-06	3.16E-08	1.18E-05	0.43	2.63E-06	2.04E-05
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.22	3.07E-03	0.05	7.02E-03	6.80E-03	1.32E-04	1.05E-06	3.95E-04	14.21	8.77E-05	6.80E-04
OSS Jacket Install Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.30	4.54E-03	0.07	1.00E-02	9.72E-03	1.94E-04	1.49E-06	5.83E-04	21.01	1.30E-04	1.00E-03
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.48	7.29E-03	0.12	1.62E-02	1.56E-02	3.13E-04	2.40E-06	9.38E-04	33.77	2.08E-04	1.62E-03
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.02	3.34E-04	0.01	7.63E-04	7.39E-04	1.43E-05	1.14E-07	4.29E-05	1.55	9.54E-06	7.39E-05
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.28	3.71E-03	0.07	8.48E-03	8.22E-03	1.59E-04	1.27E-06	4.77E-04	17.18	1.06E-04	8.22E-04
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,500	2,500	0.11	1.71E-03	0.03	3.79E-03	3.67E-03	7.34E-05	5.63E-07	2.20E-04	7.93	4.90E-05	3.79E-04
		OV5M1	Main Engine - Maneuvering	1	2,500	2,500	0.18	2.75E-03	0.05	6.10E-03	5.90E-03	1.18E-04	9.05E-07	3.54E-04	12.75	7.87E-05	6.10E-04
		OV5AT1	Auxiliary Engines - Transit		199	199	0.01	9.20E-05	0.00	2.10E-04	2.04E-04	3.94E-06	3.16E-08	1.18E-05	0.43	2.63E-06	2.04E-05
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.05	6.14E-04	0.01	1.40E-03	1.36E-03	2.63E-05	2.11E-07	7.89E-05	2.84	1.75E-05	1.36E-04
OSS Topside Transport (assume separate from Jacket/piles)	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.24	4.48E-03	0.06	8.21E-03	7.96E-03	8.21E-04	1.12E-06	5.22E-04	16.01	9.95E-05	7.71E-04
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.76	1.44E-02	0.18	2.64E-02	2.56E-02	2.64E-03	3.60E-06	1.68E-03	51.47	3.20E-04	2.48E-03
		OV6AT1	Auxiliary Engines - Transit		199	199	0.01	7.07E-05	0.00	1.62E-04	1.56E-04	3.03E-06	2.42E-08	9.09E-06	0.33	2.02E-06	1.56E-05
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.07	9.43E-04	0.02	2.16E-03	2.09E-03	4.04E-05	3.23E-07	1.21E-04	4.37	2.69E-05	2.09E-04
Refueling operations to OSS and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.34	5.14E-03	0.08	1.14E-02	1.10E-02	2.20E-04	1.69E-06	6.61E-04	23.79	1.47E-04	1.14E-03
		OV7M1	Main Engine - Maneuvering	2	749	1,498	1.94	2.97E-02	0.49	6.58E-02	6.37E-02	1.27E-03	9.76E-06	3.82E-03	137.56	8.49E-04	6.58E-03
		OV7AT1	Auxiliary Engines - Transit		20	40	0.01	9.26E-05	0.00	2.12E-04	2.05E-04	3.97E-06	3.17E-08	1.19E-05	0.43	2.64E-06	2.05E-05
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.16	2.22E-03	0.04	5.08E-03	4.92E-03	9.52E-05	7.62E-07	2.86E-04	10.29	6.35E-05	4.92E-04
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.53	7.46E-03	0.12	1.65E-02	1.60E-02	6.93E-04	2.40E-06	9.60E-04	34.49	2.13E-04	1.65E-03
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	2.09	2.91E-02	0.48	6.45E-02	6.24E-02	2.71E-03	9.36E-06	3.75E-03	134.65	8.32E-04	6.45E-03
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.14	1.65E-03	0.03	3.76E-03	3.64E-03	7.05E-05	5.64E-07	2.12E-04	7.62	4.70E-05	3.64E-04
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	2.20	2.67E-02	0.47	6.09E-02	5.90E-02	1.14E-03	9.14E-06	3.43E-03	123.40	7.62E-04	5.90E-03
OSS emergency generators	150 kW standard diesel generator	OD1	Engine	4	150	600	0.26	1.26E-01	2.31	1.98E-02	1.98E-02	4.50E-03	0.00E+00	1.16E-02	489.15	1.98E-02	3.97E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-34
US Wind, Inc. - Maryland Offshore Wind Project
Inter-Array Cable Installation - Annual Emissions - Year 3

Vessel Information							Year 3										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Inter-Array Cable Installation																	
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	IV1T1	Main Engine - In Transit		1,750	5,250	0.73	1.91E-02	0.17	2.60E-02	2.53E-02	6.51E-03	2.99E-06	2.07E-03	48.62	3.06E-04	2.37E-03
		IV1M1	Main Engine - Maneuvering		1,750	5,250	12.77	3.36E-01	2.96	4.58E-01	4.44E-01	1.14E-01	5.25E-05	3.63E-02	854.69	5.38E-03	4.17E-02
		IV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.17	2.41E-03	0.04	5.51E-03	5.34E-03	1.03E-04	8.26E-07	3.10E-04	11.16	6.89E-05	5.34E-04
		IV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	12.42	1.76E-01	3.12	4.02E-01	3.89E-01	7.54E-03	6.03E-05	2.26E-02	814.27	5.02E-03	3.89E-02
Pre-lay grapnel run	Multipurpose offshore support vessel	IV2T1	Main Engine - In Transit		1611	1611	0.08	1.48E-03	0.02	2.71E-03	2.63E-03	2.71E-04	3.70E-07	1.73E-04	5.29	3.29E-05	2.55E-04
		IV2M1	Main Engine - Maneuvering	1	1611	1611	0.34	6.50E-03	0.08	1.19E-02	1.16E-02	1.19E-03	1.63E-06	7.59E-04	23.26	1.45E-04	1.12E-03
		IV2AT1	Auxiliary Engines - Transit		123	246	0.01	9.11E-05	0.00	2.08E-04	2.02E-04	3.90E-06	3.12E-08	1.17E-05	0.42	2.60E-06	2.02E-05
		IV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.12	1.66E-03	0.03	3.80E-03	3.68E-03	7.12E-05	5.69E-07	2.14E-04	7.69	4.75E-05	3.68E-04
Crew transfer vessel 1	Crew transfer vessel	IV3T1	Main Engine - In Transit		749	1,498	1.82	2.79E-02	0.46	6.17E-02	5.97E-02	1.19E-03	9.16E-06	3.58E-03	129.03	7.96E-04	6.17E-03
		IV3M1	Main Engine - Maneuvering	2	749	1,498	4.05	6.19E-02	1.02	1.37E-01	1.33E-01	2.65E-03	2.03E-05	7.96E-03	286.58	1.77E-03	1.37E-02
		IV3AT1	Auxiliary Engines - Transit		20	40	0.03	3.86E-04	0.01	8.81E-04	8.54E-04	1.65E-05	1.32E-07	4.96E-05	1.79	1.10E-05	8.54E-05
		IV3AM1	Auxiliary Engines - Maneuvering	2	20	40	0.26	3.55E-03	0.06	8.12E-03	7.87E-03	1.52E-04	1.22E-06	4.57E-04	16.45	1.02E-04	7.87E-04
Crew transfer vessel 2	Crew transfer vessel	IV4T1	Main Engine - In Transit		749	1,498	1.82	2.79E-02	0.46	6.17E-02	5.97E-02	1.19E-03	9.16E-06	3.58E-03	129.03	7.96E-04	6.17E-03
		IV4M1	Main Engine - Maneuvering	2	749	1,498	4.05	6.19E-02	1.02	1.37E-01	1.33E-01	2.65E-03	2.03E-05	7.96E-03	286.58	1.77E-03	1.37E-02
		IV4AT1	Auxiliary Engines - Transit		20	40	0.03	3.86E-04	0.01	8.81E-04	8.54E-04	1.65E-05	1.32E-07	4.96E-05	1.79	1.10E-05	8.54E-05
		IV4AM1	Auxiliary Engines - Maneuvering	2	20	40	0.26	3.55E-03	0.06	8.12E-03	7.87E-03	1.52E-04	1.22E-06	4.57E-04	16.45	1.02E-04	7.87E-04
Trenching vessel	Purpose-built offshore construction/ROV/survey vessel	IV5T1	Main Engine - In Transit		3,000	15,000	0.73	1.91E-02	0.17	2.60E-02	2.53E-02	6.51E-03	2.99E-06	2.07E-03	48.62	3.06E-04	2.37E-03
		IV5M1	Main Engine - Maneuvering		3,000	15,000	36.41	9.59E-01	8.44	1.30E+00	1.27E+00	3.26E-01	1.50E-04	1.04E-01	2436.62	1.53E-02	1.19E-01
		IV5AT1	Auxiliary Engines - Transit		3,000	3,000	0.05	6.97E-04	0.01	1.59E-03	1.54E-03	2.99E-05	2.39E-07	8.97E-05	3.23	1.99E-05	1.54E-04
		IV5AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	17.08	2.42E-01	4.28	5.53E-01	5.35E-01	1.04E-02	8.29E-05	3.11E-02	1119.24	6.91E-03	5.35E-02
Guard vessel	Crew transfer vessel	IV6T1	Main Engine - In Transit		749	1,498	0.11	1.72E-03	0.03	3.81E-03	3.69E-03	7.37E-05	5.65E-07	2.21E-04	7.97	4.92E-05	3.81E-04
		IV6M1	Main Engine - Maneuvering	2	749	1,498	0.81	1.24E-02	0.20	2.74E-02	2.65E-02	5.31E-04	4.07E-06	1.59E-03	57.32	3.54E-04	2.74E-03
		IV6AT1	Auxiliary Engines - Transit		20	40	0.00	2.38E-05	0.00	5.44E-05	5.27E-05	1.02E-06	8.16E-09	3.06E-06	0.11	6.80E-07	5.27E-06
		IV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.05	7.11E-04	0.01	1.62E-03	1.57E-03	3.05E-05	2.44E-07	9.14E-05	3.29	2.03E-05	1.57E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-35
US Wind, Inc. - Maryland Offshore Wind Project
Offshore Export Cable Installation - Annual Emissions - Year 3

Vessel Information							Year 3										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Construction																	
Offshore Export Cable Installation																	
Offshore export cable pre-lay survey, trenching, cable lay and pull	Cable lay vessel	ECV1T1	Main Engine - In Transit		1,750	5,250	0.24	6.38E-03	0.06	8.68E-03	8.42E-03	2.17E-03	9.95E-07	6.89E-04	16.21	1.02E-04	7.91E-04
		ECV1M1	Main Engine - Maneuvering		1,750	5,250	11.76	3.10E-01	2.73	4.21E-01	4.09E-01	1.05E-01	4.83E-05	3.35E-02	787.21	4.96E-03	3.84E-02
		ECV1AT1	Auxiliary Engines - Transit		1,750	1,750	0.06	8.03E-04	0.01	1.84E-03	1.78E-03	3.44E-05	2.75E-07	1.03E-04	3.72	2.30E-05	1.78E-04
		ECV1AM1	Auxiliary Engines - Maneuvering	4	1,750	1,750	11.44	1.62E-01	2.87	3.70E-01	3.59E-01	6.94E-03	5.55E-05	2.08E-02	749.98	4.63E-03	3.59E-02
Pre-lay grapnel run & pre-lay survey; post lay survey after completion	Multipurpose offshore support vessel	ECV2T1	Main Engine - In Transit		1,611	1,611	0.16	4.11E-03	0.04	5.59E-03	5.43E-03	1.40E-03	6.41E-07	4.44E-04	10.44	6.58E-05	5.10E-04
		ECV2M1	Main Engine - Maneuvering	1	1,611	1,611	1.20	3.17E-02	0.28	4.31E-02	4.18E-02	1.08E-02	4.95E-06	3.42E-03	80.52	5.07E-04	3.93E-03
		ECV2AT1	Auxiliary Engines - Transit		123	246	0.01	1.82E-04	0.00	4.16E-04	4.03E-04	7.81E-06	6.24E-08	2.34E-05	0.84	5.20E-06	4.03E-05
		ECV2AM1	Auxiliary Engines - Maneuvering	2	123	246	0.41	5.83E-03	0.10	1.33E-02	1.29E-02	2.50E-04	2.00E-06	7.49E-04	26.98	1.67E-04	1.29E-03
Trenching vessel	Purpose built offshore construction/survey vessel	ECV3T1	Main Engine - In Transit		3,000	15,000	0.73	1.91E-02	0.17	2.60E-02	2.53E-02	6.51E-03	2.99E-06	2.07E-03	48.62	3.06E-04	2.37E-03
		ECV3M1	Main Engine - Maneuvering		3,000	15,000	33.61	8.85E-01	7.79	1.20E+00	1.17E+00	3.01E-01	1.38E-04	9.56E-02	2249.19	1.42E-02	1.10E-01
		ECV3AT1	Auxiliary Engines - Transit		3,000	3,000	0.05	6.97E-04	0.01	1.59E-03	1.54E-03	2.99E-05	2.39E-07	8.97E-05	3.23	1.99E-05	1.54E-04
		ECV3AM1	Auxiliary Engines - Maneuvering	6	3,000	3,000	15.76	2.23E-01	3.95	5.10E-01	4.94E-01	9.56E-03	7.65E-05	2.87E-02	1033.14	6.38E-03	4.94E-02
HDD pull in lift vessel	Jack-up vessel	ECV4T1	Main Engine - In Transit		2,350	4,700	0.53	7.46E-03	0.12	1.65E-02	1.60E-02	6.93E-04	2.40E-06	9.60E-04	34.49	2.13E-04	1.65E-03
		ECV4M1	Main Engine - Maneuvering	2	2,350	4,700	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		ECV4AT1	Auxiliary Engines - Transit		1,000	2,000	0.14	1.65E-03	0.03	3.76E-03	3.64E-03	7.05E-05	5.64E-07	2.12E-04	7.62	4.70E-05	3.64E-04
		ECV4AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	2.74	3.32E-02	0.59	7.58E-02	7.34E-02	1.42E-03	1.14E-05	4.26E-03	153.57	9.48E-04	7.34E-03
Diving support for HDD pull in	Research / Survey	ECV5T1	Main Engine - In Transit		392	784	0.04	7.82E-04	0.01	1.21E-03	1.17E-03	2.35E-04	1.49E-07	8.89E-05	2.27	1.42E-05	1.10E-04
		ECV5M1	Main Engine - Maneuvering	2	392	784	0.43	9.50E-03	0.10	1.47E-02	1.43E-02	2.85E-03	1.81E-06	1.08E-03	27.57	1.73E-04	1.34E-03
		ECV5AT1	Auxiliary Engines - Transit		135	270	0.01	8.88E-05	0.00	2.03E-04	1.97E-04	3.81E-06	3.05E-08	1.14E-05	0.41	2.54E-06	1.97E-05
		ECV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.33	4.48E-03	0.08	1.02E-02	9.91E-03	1.92E-04	1.54E-06	5.76E-04	20.73	1.28E-04	9.91E-04
HDD pull in support vessel	Multipurpose offshore support vessel	ECV6T1	Main Engine - In Transit		1,611	1,611	0.97	2.56E-02	0.23	3.48E-02	3.38E-02	8.70E-03	3.99E-06	2.76E-03	64.98	4.09E-04	3.17E-03
		ECV6M1	Main Engine - Maneuvering	1	1,611	1,611	0.84	2.22E-02	0.20	3.02E-02	2.93E-02	7.54E-03	3.46E-06	2.40E-03	56.36	3.55E-04	2.75E-03
		ECV6AT1	Auxiliary Engines - Transit		123	246	0.08	1.13E-03	0.02	2.59E-03	2.51E-03	4.86E-05	3.89E-07	1.46E-04	5.25	3.24E-05	2.51E-04
		ECV6AM1	Auxiliary Engines - Maneuvering	2	123	246	0.29	4.08E-03	0.07	9.32E-03	9.03E-03	1.75E-04	1.40E-06	5.25E-04	18.89	1.17E-04	9.03E-04

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-36
US Wind, Inc. - Maryland Offshore Wind Project
Met Tower Installation - Annual Emissions - Year 3

Vessel Information													Year 3										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
Met Tower Installation Air Permit Emissions During Construction																						
Met Tower Installation																						
Met Tower installation	Heavy lift vessel	OV1T1	Main Engine - In Transit		4,500	22,500	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1M1	Main Engine - Maneuvering		4,500	22,500	0.00					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1AT1	Auxiliary Engines - Transit		4,500	4,500	0.27	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV1AM1	Auxiliary Engines - Maneuvering	6	4,500	4,500	0.45					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Assisting tug	Tug	OV2T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV2M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV2AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV2AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Met Tower PilesTransport	Tug	OV3T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV3M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV3AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV3AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit		3,310	6,620	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV4M1	Main Engine - Maneuvering	2	3,310	6,620	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV4AT1	Auxiliary Engines - Transit		499	1497	0.27	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV4AM1	Auxiliary Engines - Maneuvering	3	499	1497	0.45					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit		2,540	2,500	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV5M1	Main Engine - Maneuvering	2	2,540	2,500	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV5AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV5AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Met Tower Topside Transport	Tug	OV6T1	Main Engine - In Transit		2,540	5,080	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV6M1	Main Engine - Maneuvering	2	2,540	5,080	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV6AT1	Auxiliary Engines - Transit		199	199	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV6AM1	Auxiliary Engines - Maneuvering	1	199	199	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Refueling operations to Met Tower and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit		749	1,498	0.83	50	9	450	Norfolk	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV7M1	Main Engine - Maneuvering	2	749	1,498	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV7AT1	Auxiliary Engines - Transit		20	40	0.43	50	9	450		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows Point	0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV8M1	Main Engine - Maneuvering	2	2,350	4,700	0.2					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV8AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OV8AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43					0.00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-37
US Wind, Inc. - Maryland Offshore Wind Project
Operations and Maintenance - Short-Term Emissions

Vessel Information												Operation and Emission Factors																		
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	Assumed Vessel Speed (knots)	Days Operating within the WDA	Hours in Transit within 25 miles of Project	Operating Hours per Day at WDA	Total Non-Transit Operating Hours	Total Annual Operating Hours	EF Reference	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	SO2 (g/kWh)	Pb (g/kWh)	HAPs (g/kWh)	CO2 (g/kWh)	CH4 (g/kWh)	N2O (g/kWh)
OCS Air Permit Emissions During Operations																														
Scour Protection Repairs																														
Scour protection repair	Fallpipe vessel	OMV1T1	Main Engine - In Transit		4,500	13,500	0.83	50	1	50	Sparrows Point	13.5		4		0	4	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		OMV1M1	Main Engine - Maneuvering	3	4,500	13,500	0.2						0		24	7	7	3M	9.49	0.25	2.20	0.34	0.33	0.09	3.90E-05	0.03	635.02	0.004	0.03
		OMV1AT1	Auxiliary Engines - Transit		492	492	0.27	50	1	50		13.5		4		0	4	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	0.45						0		24	7	7	3A	9.89	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
OSS O&M																														
Refueling operations to OSS	Crew transfer vessel	OMV2T1	Main Engine - In Transit		749	1,498	0.83	33	20	651	Ocean City	25		26		0	26	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV2M1	Main Engine - Maneuvering	2	749	1,498	0.2						1		12	10	10	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV2AT1	Auxiliary Engines - Transit		20	40	0.43	33	20	651		25		26		0	26	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV2AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						1		12	10	10	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
WTG Inspection/ Maintenance /Repairs																														
Main repair vessel	Jack-up vessel	OMV3T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows Point	6		8		0	8	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OMV3M1	Main Engine - Maneuvering	2	2,350	4,700	0.00						9		12	109	109	7M	10.03	0.14	2.30	0.31	0.30	0.01	4.50E-05	0.02	647.08	0.004	0.03
		OMV3AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		6		8		0	8	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV3AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43						9		12	109	109	7A	11.55	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Ad hoc survey workand cable survey/inspections	Multi-role survey vessel	OMV4T1	Main Engine - In Transit		392	784	0.83	50	8	400	Sparrows Point	18		22		0	22	8M	9.86	0.22	2.25	0.34	0.33	0.07	4.20E-05	0.03	638.26	0.004	0.03
		OMV4M1	Main Engine - Maneuvering	2	392	784	0.2						3		12	38	38	8M	9.86	0.22	2.25	0.34	0.33	0.07	4.20E-05	0.03	638.26	0.004	0.03
		OMV4AT1	Auxiliary Engines - Transit		135	270	0.43	50	8	400		18		22		0	22	8A	10.21	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV4AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43						3		12	38	38	8A	10.21	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Cable Inspection/Repairs																														
Cable burial repair	Multi-role survey vessel	OMV5T1	Main Engine - In Transit		392	784	0.83	50	5	250	Sparrows Point	18		14		0	14	8M	9.86	0.22	2.25	0.34	0.33	0.07	4.20E-05	0.03	638.26	0.004	0.03
		OMV5M1	Main Engine - Maneuvering	2	392	784	0.2						2		24	48	48	8M	9.86	0.22	2.25	0.34	0.33	0.07	4.20E-05	0.03	638.26	0.004	0.03
		OMV5AT1	Auxiliary Engines - Transit		135	270	0.43	50	5	250		18		14		0	14	8A	10.21	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43						2		24	48	48	8A	10.21	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Daily O&M and Miscellaneous																														
Daily crew transfer vessel	Crew transfer vessel #1	OMV6T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	25		475		0	475	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV6M1	Main Engine - Maneuvering	2	749	1,498	0.2						365		12	4,380	4380	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV6AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		25		475		0	475	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						365		12	4,380	4380	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
Daily crew transfer vessel	Crew transfer vessel #2	OMV7T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	25		475		0	475	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV7M1	Main Engine - Maneuvering	2	749	1,498	0.2						365		12	4,380	4380	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV7AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		25		475		0	475	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						365		12	4,380	4380	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
Daily crew transfer vessel	Crew transfer vessel #3	OMV8T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	25		475		0	475	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV8M1	Main Engine - Maneuvering	2	749	1,498	0.2						365		12	4,380	4380	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV8AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		25		475		0	475	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV8AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						365		12	4,380	4380	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
Daily crew transfer vessel	Crew transfer vessel #4	OMV9T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	25		475		0	475	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV9M1	Main Engine - Maneuvering	2	749	1,498	0.2						365		12	4,380	4380	12M	1.80	0.19	2.30	0.04	0.04	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV9AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		25		475		0	475	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV9AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						365		12	4,380	4380	12A	5.80	0.14	2.48	0.15	0.15	0.01	4.80E-05	0.02	648.20	0.004	0.03
Environmental monitoring Vessel	Sportfisher	OMV10T1	Main Engine - In Transit		749	1,498	0.83	33	100	3,255	Ocean City	10		325		0	325	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV10M1	Main Engine - Maneuvering	2	749	1,498	0.2						4		12	48	48	4M	9.15	0.14	2.30	0.31	0.30	0.01	4.60E-05	0.02	648.16	0.004	0.03
		OMV10AT1	Auxiliary Engines - Transit		20	40	0.43	33	100	3,255		10		325		0	325	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
		OMV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43						4		12	48	48	4A	10.39	0.14	2.48	0.32	0.31	0.01	4.80E-05	0.02	648.20	0.004	0.03
Electrical Service	150 kW standard diesel	OMD1	Engine	4	150	600	1.00	N/A	N/A	N/A	N/A		365	0	24	1,000	1000	T4	0.40	0.19	3.50	0.03	0.03	0.01	0.00	0.02	739.60	0.03	0.01

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-38
US Wind, Inc. - Maryland Offshore Wind Project
Operations and Maintenance - Short-Term Emissions

Vessel Information												Short-Term Emissions										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	NOx (lb/hr)	VOC (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Pb (lb/hr)	HAPs (lb/hr)	CO2 (lb/hr)	CH4 (lb/hr)	N2O (lb/hr)
OCS Air Permit Emissions During Operations																						
Scour Protection Repairs																						
Scour protection repair	Fallpipe vessel	OMV1T1	Main Engine - In Transit		4,500	13,500	0.83	50	1	50	Sparrows Point	234.43	6.18	54.35	8.40	8.15	2.10E+00	9.63E-04	6.67E-01	15686.51	9.88E-02	7.66E-01
		OMV1M1	Main Engine - Maneuvering	3	4,500	13,500	0.2					56.49	1.49	13.10	2.02	1.96	5.06E-01	2.32E-04	1.61E-01	3779.88	2.38E-02	1.85E-01
		OMV1AT1	Auxiliary Engines - Transit		492	492	0.27	50	1	50		2.90	0.04	0.73	0.09	0.09	1.76E-03	1.41E-05	5.27E-03	189.83	1.17E-03	9.08E-03
		OMV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	0.45					11.77	0.17	2.95	0.38	0.37	7.14E-03	5.71E-05	2.14E-02	771.67	4.76E-03	3.69E-02
OSS O&M																						
Refueling operations to OSS	Crew transfer vessel	OMV2T1	Main Engine - In Transit		749	1,498	0.83	33	20	651	Ocean City	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OMV2M1	Main Engine - Maneuvering	2	749	1,498	0.2					6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OMV2AT1	Auxiliary Engines - Transit		20	40	0.43	33	20	651		0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		OMV2AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
WTG Inspection/ Maintenance /Repairs																						
Main repair vessel	Jack-up vessel	OMV3T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows Point	86.26	1.20	19.78	2.67	2.58	1.12E-01	3.87E-04	1.55E-01	5564.95	3.44E-02	2.67E-01
		OMV3M1	Main Engine - Maneuvering	2	2,350	4,700	0.00					0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00
		OMV3AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02
		OMV3AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43					21.90	0.27	4.70	0.61	0.59	1.14E-02	9.10E-05	3.41E-02	1228.95	7.58E-03	5.88E-02
Ad hoc survey workand cable survey/inspections	Multi-role survey vessel	OMV4T1	Main Engine - In Transit		392	784	0.83	50	8	400	Sparrows Point	14.14	0.32	3.23	0.49	0.47	9.47E-02	6.03E-05	3.59E-02	915.63	5.74E-03	4.45E-02
		OMV4M1	Main Engine - Maneuvering	2	392	784	0.2					3.41	0.08	0.78	0.12	0.11	2.28E-02	1.45E-05	8.64E-03	220.63	1.38E-03	1.07E-02
		OMV4AT1	Auxiliary Engines - Transit		135	270	0.43	50	8	400		2.61	0.04	0.63	0.08	0.08	1.54E-03	1.23E-05	4.61E-03	165.91	1.02E-03	7.93E-03
		OMV4AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43					2.61	0.04	0.63	0.08	0.08	1.54E-03	1.23E-05	4.61E-03	165.91	1.02E-03	7.93E-03
Cable Inspection/Repairs																						
Cable burial repair	Multi-role survey vessel	OMV5T1	Main Engine - In Transit		392	784	0.83	50	5	250	Sparrows Point	14.14	0.32	3.23	0.49	0.47	9.47E-02	6.03E-05	3.59E-02	915.63	5.74E-03	4.45E-02
		OMV5M1	Main Engine - Maneuvering	2	392	784	0.2					3.41	0.08	0.78	0.12	0.11	2.28E-02	1.45E-05	8.64E-03	220.63	1.38E-03	1.07E-02
		OMV5AT1	Auxiliary Engines - Transit		135	270	0.43	50	5	250		2.61	0.04	0.63	0.08	0.08	1.54E-03	1.23E-05	4.61E-03	165.91	1.02E-03	7.93E-03
		OMV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43					2.61	0.04	0.63	0.08	0.08	1.54E-03	1.23E-05	4.61E-03	165.91	1.02E-03	7.93E-03
Daily O&M and Miscellaneous																						
Daily crew transfer vessel	Crew transfer vessel #1	OMV6T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	4.93	0.52	6.30	0.11	0.11	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OMV6M1	Main Engine - Maneuvering	2	749	1,498	0.2					1.19	0.13	1.52	0.03	0.03	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OMV6AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		OMV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Daily crew transfer vessel	Crew transfer vessel #2	OMV7T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	4.93	0.52	6.30	0.11	0.11	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OMV7M1	Main Engine - Maneuvering	2	749	1,498	0.2					1.19	0.13	1.52	0.03	0.03	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OMV7AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		OMV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Daily crew transfer vessel	Crew transfer vessel #3	OMV8T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	4.93	0.52	6.30	0.11	0.11	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OMV8M1	Main Engine - Maneuvering	2	749	1,498	0.2					1.19	0.13	1.52	0.03	0.03	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OMV8AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		OMV8AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Daily crew transfer vessel	Crew transfer vessel #4	OMV9T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	4.93	0.52	6.30	0.11	0.11	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OMV9M1	Main Engine - Maneuvering	2	749	1,498	0.2					1.19	0.13	1.52	0.03	0.03	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OMV9AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		OMV9AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.22	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Environmental monitoring Vessel	Sportfisher	OMV10T1	Main Engine - In Transit		749	1,498	0.83	33	100	3,255	Ocean City	25.08	0.38	6.30	0.85	0.82	1.64E-02	1.26E-04	4.93E-02	1776.64	1.10E-02	8.50E-02
		OMV10M1	Main Engine - Maneuvering	2	749	1,498	0.2					6.04	0.09	1.52	0.20	0.20	3.96E-03	3.04E-05	1.19E-02	428.11	2.64E-03	2.05E-02
		OMV10AT1	Auxiliary Engines - Transit		20	40	0.43	33	100	3,255		0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
		OMV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					0.39	0.01	0.09	0.01	0.01	2.28E-04	1.82E-06	6.83E-04	24.58	1.52E-04	1.18E-03
Electrical Service	150 kW standard diesel	OMD1	Engine	4	150	600	1.00	N/A	N/A	N/A	N/A	0.53	0.25	4.63	0.04	0.04	8.99E-03	0.00E+00	2.33E-02	978.31	3.97E-02	7.94E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
EF Reference corresponds to emission factors in Table A-40.

Table A-39
US Wind, Inc. - Maryland Offshore Wind Project
Operations and Maintenance - Maximum Annual Emissions

Vessel Information												Operational Years										
Activity	Representative Vessel Type	AERMOD ID	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Engine Load Factor (%)	Distance per Round Trip (nautical miles)	Number of Round Trips	Total Distance Traveled (nautical miles)	Homeport During Project	NOx (ton/year)	VOC (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Pb (ton/year)	HAPs (ton/year)	CO2 (ton/year)	CH4 (ton/year)	N2O (ton/year)
OCS Air Permit Emissions During Operations																						
Scour Protection Repairs																						
Scour protection repair	Fallpipe vessel	OMV1T1	Main Engine - In Transit		4,500	13,500	0.83	50	1	50	Sparrows Point	4.34E-01	1.14E-02	1.01E-01	1.56E-02	1.51E-02	3.89E-03	1.78E-06	1.24E-03	2.90E+01	1.83E-04	1.42E-03
		OMV1M1	Main Engine - Maneuvering	3	4,500	13,500	0.2					1.90E-01	5.00E-03	4.40E-02	6.80E-03	6.60E-03	1.70E-03	7.80E-07	5.40E-04	1.27E+01	8.00E-05	6.20E-04
		OMV1AT1	Auxiliary Engines - Transit		492	492	0.27	50	1	50		5.36E-03	7.59E-05	1.34E-03	1.74E-04	1.68E-04	3.25E-06	2.60E-08	9.76E-06	3.52E-01	2.17E-06	1.68E-05
		OMV1AM1	Auxiliary Engines - Maneuvering	2	1200	1200	0.45					3.96E-02	5.60E-04	9.92E-03	1.28E-03	1.24E-03	2.40E-05	1.92E-07	7.20E-05	2.59E+00	1.60E-05	1.24E-04
OSS O&M																						
Refueling operations to OSS	Crew transfer vessel	OMV2T1	Main Engine - In Transit		749	1,498	0.83	33	20	651	Ocean City	3.27E-01	5.00E-03	8.21E-02	1.11E-02	1.07E-02	2.14E-04	1.64E-06	6.42E-04	2.31E+01	1.43E-04	1.11E-03
		OMV2M1	Main Engine - Maneuvering	2	749	1,498	0.2					2.90E-02	4.44E-04	7.29E-03	9.83E-04	9.51E-04	1.90E-05	1.46E-07	5.71E-05	2.05E+00	1.27E-05	9.83E-05
		OMV2AT1	Auxiliary Engines - Transit		20	40	0.43	33	20	651		5.13E-03	6.91E-05	1.22E-03	1.58E-04	1.53E-04	2.96E-06	2.37E-08	8.89E-06	3.20E-01	1.97E-06	1.53E-05
		OMV2AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					1.89E-03	2.55E-05	4.51E-04	5.82E-05	5.64E-05	1.09E-06	8.74E-09	3.28E-06	1.18E-01	7.28E-07	5.64E-06
WTG Inspection/ Maintenance /Repairs																						
Main repair vessel	Jack-up vessel	OMV3T1	Main Engine - In Transit		2,350	4,700	0.83	50	1	50	Sparrows Point	3.59E-01	5.02E-03	8.24E-02	1.11E-02	1.08E-02	4.66E-04	1.61E-06	6.45E-04	2.32E+01	1.43E-04	1.11E-03
		OMV3M1	Main Engine - Maneuvering	2	2,350	4,700	0.00					0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		OMV3AT1	Auxiliary Engines - Transit		1,000	2,000	0.43	50	1	50		9.12E-02	1.11E-03	1.96E-02	2.53E-03	2.45E-03	4.74E-05	3.79E-07	1.42E-04	5.12E+00	3.16E-05	2.45E-04
		OMV3AM1	Auxiliary Engines - Maneuvering	2	1,000	2,000	0.43					1.20E+00	1.45E-02	2.57E-01	3.32E-02	3.22E-02	6.22E-04	4.98E-06	1.87E-03	6.72E+01	4.15E-04	3.22E-03
Ad hoc survey workand cable survey/inspections	Multi-role survey vessel	OMV4T1	Main Engine - In Transit		392	784	0.83	50	8	400	Sparrows Point	1.57E-01	3.51E-03	3.59E-02	5.42E-03	5.26E-03	1.05E-03	6.69E-07	3.98E-04	1.02E+01	6.38E-05	4.94E-04
		OMV4M1	Main Engine - Maneuvering	2	392	784	0.2					6.54E-02	1.46E-03	1.49E-02	2.26E-03	2.19E-03	4.38E-04	2.79E-07	1.66E-04	4.24E+00	2.65E-05	2.06E-04
		OMV4AT1	Auxiliary Engines - Transit		135	270	0.43	50	8	400		2.90E-02	3.98E-04	7.05E-03	9.10E-04	8.82E-04	1.71E-05	1.37E-07	5.12E-05	1.84E+00	1.14E-05	8.82E-05
		OMV4AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43					5.02E-02	6.88E-04	1.22E-02	1.57E-03	1.52E-03	2.95E-05	2.36E-07	8.85E-05	3.19E+00	1.97E-05	1.52E-04
Cable Inspection/Repairs																						
Cable burial repair	Multi-role survey vessel	OMV5T1	Main Engine - In Transit		392	784	0.83	50	5	250	Sparrows Point	9.82E-02	2.19E-03	2.24E-02	3.39E-03	3.29E-03	6.58E-04	4.18E-07	2.49E-04	6.36E+00	3.98E-05	3.09E-04
		OMV5M1	Main Engine - Maneuvering	2	392	784	0.2					8.18E-02	1.83E-03	1.87E-02	2.82E-03	2.74E-03	5.48E-04	3.48E-07	2.07E-04	5.30E+00	3.32E-05	2.57E-04
		OMV5AT1	Auxiliary Engines - Transit		135	270	0.43	50	5	250		1.81E-02	2.49E-04	4.41E-03	5.69E-04	5.51E-04	1.07E-05	8.53E-08	3.20E-05	1.15E+00	7.11E-06	5.51E-05
		OMV5AM1	Auxiliary Engines - Maneuvering	2	135	270	0.43					6.27E-02	8.60E-04	1.52E-02	1.97E-03	1.90E-03	3.69E-05	2.95E-07	1.11E-04	3.98E+00	2.46E-05	1.90E-04
Daily O&M and Miscellaneous																						
Daily crew transfer vessel	Crew transfer vessel #1	OMV6T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	1.17E+00	1.24E-01	1.50E+00	2.61E-02	2.61E-02	3.91E-03	3.00E-05	1.17E-02	4.22E+02	2.61E-03	2.02E-02
		OMV6M1	Main Engine - Maneuvering	2	749	1,498	0.2					2.60E+00	2.75E-01	3.33E+00	5.79E-02	5.79E-02	8.68E-03	6.65E-05	2.60E-02	9.38E+02	5.79E-03	4.48E-02
		OMV6AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		5.23E-02	1.26E-03	2.23E-02	1.35E-03	1.35E-03	5.41E-05	4.32E-07	1.62E-04	5.84E+00	3.60E-05	2.79E-04
		OMV6AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					4.82E-01	1.16E-02	2.06E-01	1.25E-02	1.25E-02	4.98E-04	3.99E-06	1.49E-03	5.38E+01	3.32E-04	2.57E-03
Daily crew transfer vessel	Crew transfer vessel #2	OMV7T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	1.17E+00	1.24E-01	1.50E+00	2.61E-02	2.61E-02	3.91E-03	3.00E-05	1.17E-02	4.22E+02	2.61E-03	2.02E-02
		OMV7M1	Main Engine - Maneuvering	2	749	1,498	0.2					2.60E+00	2.75E-01	3.33E+00	5.79E-02	5.79E-02	8.68E-03	6.65E-05	2.60E-02	9.38E+02	5.79E-03	4.48E-02
		OMV7AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		5.23E-02	1.26E-03	2.23E-02	1.35E-03	1.35E-03	5.41E-05	4.32E-07	1.62E-04	5.84E+00	3.60E-05	2.79E-04
		OMV7AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					4.82E-01	1.16E-02	2.06E-01	1.25E-02	1.25E-02	4.98E-04	3.99E-06	1.49E-03	5.38E+01	3.32E-04	2.57E-03
Daily crew transfer vessel	Crew transfer vessel #3	OMV8T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	1.17E+00	1.24E-01	1.50E+00	2.61E-02	2.61E-02	3.91E-03	3.00E-05	1.17E-02	4.22E+02	2.61E-03	2.02E-02
		OMV8M1	Main Engine - Maneuvering	2	749	1,498	0.2					2.60E+00	2.75E-01	3.33E+00	5.79E-02	5.79E-02	8.68E-03	6.65E-05	2.60E-02	9.38E+02	5.79E-03	4.48E-02
		OMV8AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		5.23E-02	1.26E-03	2.23E-02	1.35E-03	1.35E-03	5.41E-05	4.32E-07	1.62E-04	5.84E+00	3.60E-05	2.79E-04
		OMV8AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					4.82E-01	1.16E-02	2.06E-01	1.25E-02	1.25E-02	4.98E-04	3.99E-06	1.49E-03	5.38E+01	3.32E-04	2.57E-03
Daily crew transfer vessel	Crew transfer vessel #4	OMV9T1	Main Engine - In Transit		749	1,498	0.83	33	365	11,880	Ocean City	1.17E+00	1.24E-01	1.50E+00	2.61E-02	2.61E-02	3.91E-03	3.00E-05	1.17E-02	4.22E+02	2.61E-03	2.02E-02
		OMV9M1	Main Engine - Maneuvering	2	749	1,498	0.2					2.60E+00	2.75E-01	3.33E+00	5.79E-02	5.79E-02	8.68E-03	6.65E-05	2.60E-02	9.38E+02	5.79E-03	4.48E-02
		OMV9AT1	Auxiliary Engines - Transit		20	40	0.43	33	365	11,880		5.23E-02	1.26E-03	2.23E-02	1.35E-03	1.35E-03	5.41E-05	4.32E-07	1.62E-04	5.84E+00	3.60E-05	2.79E-04
		OMV9AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					4.82E-01	1.16E-02	2.06E-01	1.25E-02	1.25E-02	4.98E-04	3.99E-06	1.49E-03	5.38E+01	3.32E-04	2.57E-03
Environmental monitoring Vessel	Sportfisher	OMV10T1	Main Engine - In Transit		749	1,498	0.83	33	100	3,255	Ocean City	4.08E+00	6.25E-02	1.03E+00	1.38E-01	1.34E-01	2.68E-03	2.05E-05	8.03E-03	2.89E+02	1.78E-03	1.38E-02
		OMV10M1	Main Engine - Maneuvering	2	749	1,498	0.2					1.45E-01	2.22E-03	3.65E-02	4.91E-03	4.76E-03	9.51E-05	7.29E-07	2.85E-04	1.03E+01	6.34E-05	4.91E-04
		OMV10AT1	Auxiliary Engines - Transit		20	40	0.43	33	100	3,255		6.41E-02	8.64E-04	1.53E-02	1.97E-03	1.91E-03	3.70E-05	2.96E-07	1.11E-04	4.00E+00	2.47E-05	1.91E-04
		OMV10AM1	Auxiliary Engines - Maneuvering	2	20	40	0.43					9.46E-03	1.27E-04	2.26E-03	2.91E-04	2.82E-04	5.46E-06	4.37E-08	1.64E-05	5.90E-01	3.64E-06	2.82E-05
Electrical Service	150 kW standard diesel	OMD1	Engine	4	150	600	1.00	N/A	N/A	N/A	N/A	2.65E-01	1.26E-01	2.31E+00	1.98E-02	1.98E-02	4.50E-03	0.00E+00	1.16E-02	4.89E+02	1.98E-02	3.97E-03

Note: Refer to OCS Air Permit Application Section 2 for more detailed analysis and description.
Annual emissions based on short-term emissions and hours of operation provided in Table A-2 through A-15.

Table A-40
US Wind, Inc. - Maryland Offshore Wind Project
Emission Factors

EF Ref	Vessel Type	Engine type	Emission Factors[1] (g/kWh)										
			NOx	VOC	CO	PM10	PM2.5	SO2	Pb	HAPs	CO2	CH4	N2O
1M	Anchor Handling Tugs	Main	9.26	0.24	2.16	0.34	0.33	0.079	4.00E-05	0.026	636.09	0.004	0.031
1A		Auxiliary	9.88	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
2M	Barge	Main	13.61	0.63	1.4	0.45	0.42	0.362	1.20E-05	0.06	588.9	0.004	0.031
2A		Auxiliary	12.57	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
3M	Cable Laying	Main	9.49	0.25	2.2	0.34	0.33	0.085	3.90E-05	0.027	635.02	0.004	0.031
3A		Auxiliary	9.89	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
4M	Secondary Crew	Main	9.15	0.14	2.3	0.31	0.3	0.006	4.60E-05	0.018	648.16	0.004	0.031
4A		Auxiliary	10.39	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
5M	Dredging	Main	9.6	0.28	2.13	0.36	0.34	0.112	3.70E-05	0.03	630.62	0.004	0.031
5A		Auxiliary	9.85	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
6M	Ice Breaker	Main	9.92	0.45	1.78	0.4	0.38	0.23	2.50E-05	0.044	610.83	0.004	0.031
6A		Auxiliary	10.09	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
7M	Jackup	Main	10.03	0.14	2.3	0.31	0.3	0.013	4.50E-05	0.018	647.08	0.004	0.031
7A		Auxiliary	11.55	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
8M	Research / Survey	Main	9.86	0.22	2.25	0.34	0.33	0.066	4.20E-05	0.025	638.26	0.004	0.031
8A		Auxiliary	10.21	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
9M	Shuttle Tanker	Main	9.05	0.63	1.4	0.45	0.42	0.362	1.20E-05	0.06	588.9	0.004	0.031
9A		Auxiliary	9.8	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
10M	Supply Ship	Main	9.44	0.17	2.29	0.32	0.31	0.028	4.50E-05	0.02	644.58	0.004	0.031
10A		Auxiliary	10.43	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
11M	Tug	Main	9.52	0.18	2.29	0.33	0.32	0.033	4.50E-05	0.021	643.66	0.004	0.031
11A		Auxiliary	10.1	0.14	2.48	0.32	0.31	0.006	4.80E-05	0.018	648.2	0.004	0.031
12M	Primary Crew[2]	Main	1.8	0.19	2.3	0.04	0.04	0.006	4.60E-05	0.018	648.16	0.004	0.031
12A		Auxiliary	5.8	0.14	2.48	0.15	0.15	0.006	4.80E-05	0.018	648.2	0.004	0.031

[1] Emission factors for project-specific vessels are assumed to be equivalent to BOEM Wind Tool Version 1 emission factors for the vessel that is closest in engine rating, except for primary crew vessel main engines.
[2] The NO, VOC, PM10, and PM2.5 emission facors correspond to Tier 4 emission standard in 40 CFR Part 1042.101 that this vessel type may be certified by the manufacturer as meeting per the LAER assessment

Load Factors for Main Engines		
Vessel/Engine	Activity	Load Factor
Cat. 3 Main (Propulsion) Engine	Transit/cruise	0.83
Cat. 3 Main (Propulsion) Engine	Maneuvering	0.2
Cat. 1/2 Main (Propulsion) Engine	Transit/cruise	0.83
Cat. 1/2 Main (Propulsion) Engine	Maneuvering	0.2

Emissions Factors for Engines														
			Emission Factors (g/kWh)											
EF Ref	Engine	Size (kW)	NOx	VOC	CO	PM10	PM2.5	SO2	Pb	HAPs5	CO24	CH44	N2O4
T2a	Tier 2 Engines 0-8 kW	0-8	7.5	0.929	8	0.8	0.8	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006
T2b	Tier 2 Engines 8-19 kW	9-36	7.5	0.929	6.6	0.8	0.8	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006
T2c	Tier 2 Engines 19-37 kW	19-37	7.5	0.929	5.5	0.6	0.6	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006
T3a	Tier 3 Engines 37-75 kW	37-75	4.7	0.582	5	0.4	0.4	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006
T3b	Tier 3 Engines 75-130 kW	75-130	4	0.495	5	0.3	0.3	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006
T3c	Tier 3 Engines 130-225 kW	130-225	4	0.495	3.5	0.2	0.2	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006
T3d	Tier 3 Engines 225-450 kW	225-450	4	0.495	3.5	0.2	0.2	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006
T3e	Tier 3 Engines 450-560 kW	450-560	4	0.495	3.5	0.2	0.2	0.0068	0.00E+00	7.14E-03	739.6	0.03	0.006
T2d	Tier 2 Engines >560 kW	>560	6.4	0.792	3.5	0.2	0.2	0.0068	0.00E+00	7.14E-03	739.6	0.03	0.006
T4	Tier 4 Engine 130-560 kW	130-560	0.4	0.19	3.5	0.03	0.03	0.0068	0.00E+00	1.76E-02	739.6	0.03	0.006

Source: NSPS

Load Factors for Auxiliary Engines on Vessels w/ Cat. 3 Main Engines		
Vessel Type	Maneuver	Hotel
Bulk Carrier	0.45	0.1
Bulk Carrier, Laker	0.45	0.22
Buoy Tender	0.45	0.19
Container	0.48	0.26
Crude Oil Tanker	0.33	0.22
Drilling	0.45	0.22
Fishing	0.45	0.22
Floating Production and Storage Offloading	0.45	0.22
General Cargo	0.45	0.22
Icebreaker	0.45	0.22
Jackup	0.45	0.22
LNG Tanker	0.33	0.26
LPG Tanker	0.33	0.26
Misc.	0.45	0.22
Passenger	0.8	0.64
Pipelaying	0.45	0.22
Reefer	0.67	0.32
Research	0.45	0.22
RORO	0.45	0.26
Supply	0.45	0.22
Support	0.45	0.22
Tanker	0.33	0.26
Tug	0.45	0.22
Vehicle Carrier	0.45	0.22
Well stimulation	0.45	0.22

Table 4-120 of https://www.epa.gov/sites/production/files/2018- 07/documents/nei2014v2_tsd_05jul2018.pdf

Load Factors for Auxiliary Engines on Vessels w/ Cat. 1 & 2 Main	
Vessel Group	Auxiliary Operating Load Factor
Bulk Carrier	0.1

Commercial Fishing	0.43
Container Ship	0.19
Ferry Excursion	0.43
General Cargo	0.22
Government	0.43
Miscellaneous	0.43
Offshore support	0.56
Reefer	0.32
RORO	0.26
Tanker	0.26
Tug	0.43
Work Boat	0.43

Source: Eastern Research Group. 2019. Category 1 and 2 Commercial Marine Vessel 2017 Emissions Inventory (2019). Table 4. Auxiliary and Boiler Power Surrogates
https://www.epa.gov/sites/default/files/2019-11/cmv_methodology_documentation.zip

Load Factors for Auxiliary Engines on Vessels w/ Cat. 3 Main Engines			
EPA Vessel Type (NEI Vessel Types)	**Cruise**	**RSZ**	**Maneuver**
Auto Carrier	0.15	0.3	0.45
Bulk Carrier	0.17	0.27	0.45
Container Ship	0.13	0.25	0.48
Cruise Ship (Passenger)	0.8	0.8	0.8
General Cargo (Supply, Vehicle Carrier)	0.17	0.27	0.45
Miscellaneous (Buoy Tender, Drilling, Fishing, FPSO, Icebreaker, Jackup, Miscellaneous, Pipelaying, Research, Support, Well Stimulation)	0.17	0.27	0.45
OG Tug (Tug)	0.17	0.27	0.45
Reefer	0.2	0.34	0.67
RORO	0.15	0.3	0.45
Tanker (LNG Tanker, LPG Tanker, Crude Oil Tanker)	0.24	0.28	0.33

Sources:
EPA. 2009. Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final EPA. 2015. Commercial Marine Vessels – 2014 NEI Commercial Marine Vessels Final. Table 4-17: Auxiliary
https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-resources-state-local-tribal
https://www.epa.gov/moves/current-methodologies-preparing-mobile-source-port-related-emission-inventories-final-report

Table A-41

US Wind, Inc. - Maryland Offshore Wind Project

HAP Emission Factors

2017 NEI HAPs for Marine Vessels		
Pollutant	**Basis**	**Fraction**
1,3-Butadiene	VOC	1.01E-03
2,2,4-Trimethylpentane	VOC	7.12E-03
Acenaphthene	VOC	5.09E-05
Acenaphthylene	VOC	1.18E-04
Acetaldehyde	VOC	9.78E-03
Acrolein	VOC	1.85E-03
Ammonia	PM2.5	1.92E-02
Anthracene	VOC	3.44E-04
Antimony	PM2.5	6.15E-04
Arsenic	PM2.5	2.59E-05
Benz[a]Anthracene	PM2.5	8.82E-06
Benzene	VOC	4.74E-03
Benzo[a]Pyrene	PM2.5	4.18E-06
Benzo[b]Fluoranthene	PM2.5	8.35E-06
Benzo[k]Fluoranthene	PM2.5	4.18E-06
Benzo(g,h,i)Fluoranthene	PM2.5	1.32E-04
Cadmium	PM2.5	2.36E-04
Chrysene	PM2.5	1.63E-05
Chromium (VI)	PM2.5	7.24E-09
Dibenzo[a,h]anthracene	PM2.5	8.65E-06
Ethyl Benzene	VOC	4.39E-04
Fluoranthene	PM2.5	8.97E-05
Fluorene	VOC	1.64E-04
Formaldehyde	VOC	4.27E-02
Indeno[1,2,3-c,d]Pyrene	PM2.5	8.35E-06
Lead	PM2.5	1.25E-04

Manganese	PM2.5	3.22E-06
Mercury	PM2.5	4.18E-08
Naphthalene	VOC	2.73E-03
Hexane	VOC	2.79E-03
Nickel	PM2.5	6.87E-04
Polychlorinated Biphenyls	PM2.5	4.18E-07
Phenanthrene	VOC	1.36E-03
Propionaldehyde	VOC	1.52E-03
Pyrene	PM2.5	3.37E-05
Selenium	PM2.5	4.38E-08
Toluene	VOC	2.04E-03
Xylenes (Mixed Isomers)	VOC	1.42E-03
o-Xylene	VOC	5.13E-04
Total Fraction of VOC		**0.0807**
Total Fraction of PM2.5		**0.0213**

Source: EPA 2017 NEI Development Documentation - Methodology Documentation for EPA's Commercial Marine Emissions Estimates

Stationary Internal Combustion Engine (<600 HP) HAPs from AP-42 Chapter 3.3	
Pollutant	**Emission Factor (lb/mmBtu)**
Benzene	9.33E-04
Toluene	4.09E-04
Xylenes	2.85E-04
1,3-Butadiene	3.91E-05
Formaldehyde	1.18E-03
Acetaldehyde	7.67E-04
Acrolein	9.25E-05
Total PAH	1.68E-04
Total HAP	**3.87E-03**
Total HAP Emission Factor	
lb/MMBtu	3.87E-03
g/MMBtu	1.76
Btu/kW	10,000
MMBtu/kW	0.01
g/kW	**1.76E-02**

Stationary Internal Combustion Engine (>600 HP) HAPs from AP-42 Chapter 3.4	
Pollutant	**Emission Factor (lb/mmBtu)**
Benzene	7.76E-04
Toluene	2.81E-04
Xylenes	1.93E-04
Formaldehyde	7.89E-05
Acetaldehyde	2.52E-05
Acrolein	7.88E-06
Total PAH	2.12E-04
Total HAP	**1.57E-03**
Total HAP Emission Factor	
lb/MMBtu	1.57E-03
g/MMBtu	0.71
Btu/kW	10,000
MMBtu/kW	0.01
g/kW	**7.14E-03**

Table A-42
US Wind, Inc. - Maryland Offshore Wind Project
AERMOD - Stack Parameters and Emissions - Construction Time Period

Stack Parameters and Operations												Maximum Hourly Emissions					1-Hour NO2 (Max of Transit or Manuvering)	1-Hour NO2 (Manuvering Only)	1-Hour CO	8-hour CO	24-Hour PM10	24-Hour PM25	1-Hour SO2	3-Hour SO2	24-Hour SO2
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Daily Operation Hours	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	NOx (g/s)	NOx (g/s)	CO (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	SO2 (g/s)	SO2 (g/s)
FV1T1	33.00	1.01	15.91	555.00	234.43	54.35	8.40	8.15	2.10	2	16	2.95E+01	6.85E+00	1.06E+00	1.03E+00	2.65E-01	2.95E+01	0.00E+00	6.85E+00	8.56E-01	8.82E-02	8.56E-02	2.65E-01	8.82E-02	2.20E-02
FV1M1	33.00	1.01	3.83	555.00	56.49	13.10	2.02	1.96	0.51	24	1015	7.12E+00	1.65E+00	2.55E-01	2.48E-01	6.38E-02	0.00E+00	7.12E+00	0.00E+00	1.44E+00	2.55E-01	2.48E-01	0.00E+00	4.25E-02	6.38E-02
FV1AT1	33.00	1.65	0.26	555.00	2.90	0.73	0.09	0.09	0.00	2	16	3.65E-01	9.15E-02	1.18E-02	1.14E-02	2.21E-04	0.00E+00	0.00E+00	0.00E+00	1.14E-02	9.84E-04	9.53E-04	0.00E+00	7.38E-05	1.85E-05
FV1AM1	33.00	1.65	0.63	555.00	11.77	2.95	0.38	0.37	0.01	24	1015	1.48E+00	3.72E-01	4.80E-02	4.65E-02	9.00E-04	1.48E+00	1.48E+00	3.72E-01	3.26E-01	4.80E-02	4.65E-02	9.00E-04	6.00E-04	9.00E-04
FV2T1	33.00	1.01	15.91	555.00	412.94	94.69	12.76	12.35	0.54	2	6	5.20E+01	1.19E+01	1.61E+00	1.56E+00	6.74E-02	5.20E+01	0.00E+00	1.19E+01	1.49E+00	1.34E-01	1.30E-01	6.74E-02	2.25E-02	5.62E-03
FV2M1	33.00	1.01	5.13	555.00	49.75	11.41	1.54	1.49	0.06	24	1865	6.27E+00	1.44E+00	1.94E-01	1.88E-01	8.13E-03	0.00E+00	6.27E+00	0.00E+00	1.26E+00	1.94E-01	1.88E-01	0.00E+00	5.42E-03	8.13E-03
FV2AT1	33.00	1.01	6.77	555.00	30.94	6.64	0.86	0.83	0.02	2	6	3.90E+00	8.37E-01	1.08E-01	1.05E-01	2.03E-03	0.00E+00	0.00E+00	0.00E+00	1.05E-01	9.00E-03	8.72E-03	0.00E+00	6.75E-04	1.69E-04
FV2AM1	33.00	1.01	6.77	555.00	51.56	11.07	1.43	1.38	0.03	24	1865	6.50E+00	1.40E+00	1.80E-01	1.74E-01	3.38E-03	6.50E+00	6.50E+00	1.40E+00	1.22E+00	1.80E-01	1.74E-01	3.38E-03	2.25E-03	3.38E-03
FV3T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	15	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
FV3M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	12	933	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	4.66E-02	4.52E-02	0.00E+00	6.21E-03	4.66E-03
FV3AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	15	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
FV3AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	12	933	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	3.80E-03	3.68E-03	0.00E+00	9.51E-05	7.13E-05
FV4T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	34	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
FV4M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	18	258	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	6.99E-02	6.77E-02	0.00E+00	6.21E-03	6.99E-03
FV4AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	34	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
FV4AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	18	258	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	5.70E-03	5.53E-03	0.00E+00	9.51E-05	1.07E-04
FV5T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	33	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
FV5M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	18	245	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	6.99E-02	6.77E-02	0.00E+00	6.21E-03	6.99E-03
FV5AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	33	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
FV5AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	18	245	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	5.70E-03	5.53E-03	0.00E+00	9.51E-05	1.07E-04
FV6T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	28	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
FV6M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	18	209	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	6.99E-02	6.77E-02	0.00E+00	6.21E-03	6.99E-03
FV6AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	28	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
FV6AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	18	209	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	5.70E-03	5.53E-03	0.00E+00	9.51E-05	1.07E-04
FV7T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	34	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
FV7M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	10	259	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	1.07E-02	1.04E-02	0.00E+00	3.33E-04	2.08E-04
FV7AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	34	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
FV7AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	10	259	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	6.37E-04	6.17E-04	0.00E+00	1.91E-05	1.19E-05
FV8T1	13.00	0.61	42.66	555.00	110.84	27.86	3.76	3.63	0.07	2	20	1.40E+01	3.51E+00	4.73E-01	4.58E-01	9.16E-03	1.40E+01	0.00E+00	3.51E+00	4.39E-01	3.94E-02	3.82E-02	9.16E-03	3.05E-03	7.63E-04
FV8M1	13.00	0.61	10.28	555.00	26.71	6.71	0.90	0.88	0.02	6	466	3.37E+00	8.46E-01	1.14E-01	1.10E-01	2.21E-03	0.00E+00	3.37E+00	0.00E+00	7.40E-01	2.85E-02	2.76E-02	0.00E+00	1.47E-03	5.52E-04
FV8AT1	13.00	0.25	1.77	555.00	9.26	2.21	0.29	0.28	0.01	2	20	1.17E+00	2.78E-01	3.59E-02	3.48E-02	6.74E-04	0.00E+00	0.00E+00	0.00E+00	3.48E-02	2.99E-03	2.90E-03	0.00E+00	2.25E-04	5.61E-05
FV8AM1	13.00	0.25	11.47	555.00	15.43	3.68	0.48	0.46	0.01	6	466	1.94E+00	4.64E-01	5.99E-02	5.80E-02	1.12E-03	1.94E+00	1.94E+00	4.64E-01	4.06E-01	1.50E-02	1.45E-02	1.12E-03	7.49E-04	2.81E-04
FV9T1	13.00	0.60	29.82	610.00	85.05	21.38	2.88	2.79	0.06	2	13	1.07E+01	2.69E+00	3.63E-01	3.51E-01	7.03E-03	1.07E+01	0.00E+00	2.69E+00	3.37E-01	3.03E-02	2.93E-02	7.03E-03	2.34E-03	5.86E-04
FV9M1	13.00	0.60	4.95	610.00	20.49	5.15	0.69	0.67	0.01	6	466	2.58E+00	6.49E-01	8.75E-02	8.47E-02	1.69E-03	0.00E+00	2.58E+00	0.00E+00	5.68E-01	2.19E-02	2.12E-02	0.00E+00	1.13E-03	4.23E-04
FV9AT1	13.00	0.15	23.06	897.00	2.55	0.61	0.08	0.08	0.00	2	13	3.22E-01	7.68E-02	9.91E-03	9.60E-03	1.86E-04	3.22E-01	0.00E+00	7.68E-02	9.60E-03	8.25E-04	8.00E-04	1.86E-04	6.19E-05	1.55E-05
FV9AM1	13.00	0.15	23.06	897.00	2.55	0.61	0.08	0.08	0.00	6	466	3.22E-01	7.68E-02	9.91E-03	9.60E-03	1.86E-04	0.00E+00	3.22E-01	0.00E+00	6.72E-02	2.48E-03	2.40E-03	0.00E+00	1.24E-04	4.64E-05
FV10T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	169	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
FV10M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	6	311	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	6.45E-03	6.24E-03	0.00E+00	3.33E-04	1.25E-04
FV10AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	169	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
FV10AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	6	311	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	3.82E-04	3.70E-04	0.00E+00	1.91E-05	7.17E-06
FV11T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	169	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
FV11M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	6	311	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	6.45E-03	6.24E-03	0.00E+00	3.33E-04	1.25E-04
FV11AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	169	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
FV11AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	6	311	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	3.82E-04	3.70E-04	0.00E+00	1.91E-05	7.17E-06
WV1T1	43.00	1.01	20.37	555.00	209.22	47.98	6.47	6.26	0.27	2	9	2.64E+01	6.05E+00	8.15E-01	7.89E-01	3.42E-02	2.64E+01	0.00E+00	6.05E+00	7.56E-01	6.79E-02	6.57E-02	3.42E-02	1.14E-02	2.85E-03
WV1M1	43.00	1.01	2.41	555.00	0.00	0.00	0.00	0.00	0.00	24	4364	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WV1AT1	43.00	0.60	11.40	555.00	19.80	4.25	0.55	0.53	0.01	2	9	2.49E+00	5.36E-01	6.91E-02	6.70E-02	1.30E-03	0.00E+00	0.00E+00	0.00E+00	6.70E-02	5.76E-03	5.58E-03	0.00E+00	4.32E-04	1.08E-04
WV1AM1	43.00	0.60	11.40	555.00	33.00	7.09	0.91	0.89	0.02	24	4364	4.16E+00	8.93E-01	1.15E-01	1.12E-01	2.16E-03	4.16E+00	4.16E+00	8.93E-01	7.81E-01	1.15E-01	1.12E-01	2.16E-03	1.44E-03	2.16E-03
WV2T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	95	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
WV2M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	24	949	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	9.31E-02	9.03E-02	0.00E+00	6.21E-03	9.31E-03
WV2AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	95	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
WV2AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	24	949	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	7.61E-03	7.37E-03	0.00E+00	9.51E-05	1.43E-04
WV3T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	92	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
WV3M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	24	916	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	9.31E-02	9.03E-02	0.00E+00	6.21E-03	9.31E-03
WV3AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	92	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
WV3AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	24	916	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	7.61E-03	7.37E-03	0.00E+00	9.51E-05	1.43E-04
WV4T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	26	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
WV4M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	24	4364	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	9.31E-02	9.03E-02	0.00E+00	6.21E-03	9.31E-03
WV4AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	26	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
WV4AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	24	4364	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	7.61E-03	7.37E-03	0.00E+00	9.51E-05	1.43E-04
CV1T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	215	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
CV1M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	12	2035	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	1.29E-02	1.25E-02	0.00E+00	3.33E-04	2.50E-04
CV1AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	215	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
CV1AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	12	2035	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	7.64E-04	7.41E-04	0.00E+00	1.91E-05	1.43E-05
CV2T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	212	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
CV2M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	12	2013	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	1.29E-02	1.25E-02	0.00E+00	3.33E-04	2.50E-04
CV2AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	212	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
CV2AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	12	2013	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	7.64E-04	7.41E-04	0.00E+00	1.91E-05	1.43E-05
CV3T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	124	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
CV3M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	12	1200	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	1.29E-02	1.25E-02	0.00E+00	3.33E-04	2.50E-04
CV3AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	124	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
CV3AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	12	1200	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	7.64E-04	7.41E-04	0.00E+00	1.91E-05	1.43E-05
OV1T1	33.00	1.01	15.91	555.00	412.94	94.69	12.76	12.35	0.54	2	6	5.20E+01	1.19E+01	1.61E+00	1.56E+00	6.74E-02	5.20E+01	0.00E+00	1.19E+01	1.49E+00	1.34E-01	1.30E-01	6.74E-02	2.25E-02	5.62E-03
OV1M1	33.00	1.01	5.13	555.00	49.75	11.41	1.54	1.49	0.06	24	305	6.27E+00	1.44E+00	1.94E-01	1.88E-01	8.13E-03	0.00E+00	6.27E+00	0.00E+00	1.26E+00	1.94E-01	1.88E-01	0.00E+00	5.42E-03	8.13E-03
OV1AT1	33.00	1.01	5.18	555.00	30.94	6.64	0.86	0.83	0.02	2	6	3.90E+00	8.37E-01	1.08E-01	1.05E-01	2.03E-03	0.00E+00	0.00E+00	0.00E+00	1.05E-01	9.00E-03	8.72E-03	0.00E+00	6.75E-04	1.69E-04
OV1AM1	33.00	1.01	8.63	555.00	51.56	11.07	1.43	1.38	0.03	24	305	6.50E+00	1.40E+00	1.80E-01	1.74E-01	3.38E-03	6.50E+00	6.50E+00	1.40E+00	1.22E+00	1.80E-01	1.74E-01	3.38E-03	2.25E-03	3.38E-03
OV2T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	7	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03

Stack Parameters and Operations												Maximum Hourly Emissions					1-Hour NO2 (Max of Transit or Manuvering)	1-Hour NO2 (Manuvering Only)	1-Hour CO	8-hour CO	24-Hour PM10	24-Hour PM25	1-Hour SO2	3-Hour SO2	24-Hour SO2
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Daily Operation Hours	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	NOx (g/s)	NOx (g/s)	CO (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	SO2 (g/s)	SO2 (g/s)
OV2M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	24	305	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	9.31E-02	9.03E-02	0.00E+00	6.21E-03	9.31E-03
OV2AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	7	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
OV2AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	24	305	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	7.61E-03	7.37E-03	0.00E+00	9.51E-05	1.43E-04
OV3T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	7	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
OV3M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	24	218	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	9.31E-02	9.03E-02	0.00E+00	6.21E-03	9.31E-03
OV3AT1	9.00	0.15	23.06	897.00	2.48	0.61	0.08	0.08	0.00	2	7	3.13E-01	7.68E-02	9.91E-03	9.60E-03	1.86E-04	3.13E-01	0.00E+00	7.68E-02	9.60E-03	8.25E-04	8.00E-04	1.86E-04	6.19E-05	1.55E-05
OV3AM1	9.00	0.15	23.06	897.00	2.48	0.61	0.08	0.08	0.00	24	218	3.13E-01	7.68E-02	9.91E-03	9.60E-03	1.86E-04	0.00E+00	3.13E-01	0.00E+00	6.72E-02	9.91E-03	9.60E-03	0.00E+00	1.24E-04	1.86E-04
OV4T1	13.00	0.61	42.66	555.00	110.84	27.86	3.76	3.63	0.07	2	7	1.40E+01	3.51E+00	4.73E-01	4.58E-01	9.16E-03	1.40E+01	0.00E+00	3.51E+00	4.39E-01	3.94E-02	3.82E-02	9.16E-03	3.05E-03	7.63E-04
OV4M1	13.00	0.61	10.28	555.00	26.71	6.71	0.90	0.88	0.02	12	44	3.37E+00	8.46E-01	1.14E-01	1.10E-01	2.21E-03	0.00E+00	3.37E+00	0.00E+00	7.40E-01	5.70E-02	5.52E-02	0.00E+00	1.47E-03	1.10E-03
OV4AT1	13.00	0.25	1.77	555.00	9.26	2.21	0.29	0.28	0.01	2	7	1.17E+00	2.78E-01	3.59E-02	3.48E-02	6.74E-04	0.00E+00	0.00E+00	0.00E+00	3.48E-02	2.99E-03	2.90E-03	0.00E+00	2.25E-04	5.61E-05
OV4AM1	13.00	0.25	11.47	555.00	15.43	3.68	0.48	0.46	0.01	12	44	1.94E+00	4.64E-01	5.99E-02	5.80E-02	1.12E-03	1.94E+00	1.94E+00	4.64E-01	4.06E-01	2.99E-02	2.90E-02	1.12E-03	7.49E-04	5.61E-04
OV5T1	13.00	0.60	29.82	610.00	41.86	10.52	1.42	1.37	0.03	2	7	5.27E+00	1.33E+00	1.79E-01	1.73E-01	3.46E-03	5.27E+00	0.00E+00	1.33E+00	1.66E-01	1.49E-02	1.44E-02	3.46E-03	1.15E-03	2.88E-04
OV5M1	13.00	0.60	4.95	610.00	10.09	2.54	0.34	0.33	0.01	12	44	1.27E+00	3.19E-01	4.31E-02	4.17E-02	8.33E-04	0.00E+00	1.27E+00	0.00E+00	2.80E-01	2.15E-02	2.08E-02	0.00E+00	5.56E-04	4.17E-04
OV5AT1	13.00	0.15	23.06	897.00	2.55	0.61	0.08	0.08	0.00	2	7	3.22E-01	7.68E-02	9.91E-03	9.60E-03	1.86E-04	3.22E-01	0.00E+00	7.68E-02	9.60E-03	8.25E-04	8.00E-04	1.86E-04	6.19E-05	1.55E-05
OV5AM1	13.00	0.15	23.06	897.00	2.55	0.61	0.08	0.08	0.00	12	44	3.22E-01	7.68E-02	9.91E-03	9.60E-03	1.86E-04	0.00E+00	3.22E-01	0.00E+00	6.72E-02	4.95E-03	4.80E-03	0.00E+00	1.24E-04	9.29E-05
OV6T1	9.00	0.60	29.82	610.00	88.49	21.29	3.07	2.97	0.31	2	7	1.12E+01	2.68E+00	3.87E-01	3.75E-01	3.87E-02	1.12E+01	0.00E+00	2.68E+00	3.35E-01	3.22E-02	3.12E-02	3.87E-02	1.29E-02	3.22E-03
OV6M1	9.00	0.60	4.95	610.00	21.32	5.13	0.74	0.72	0.07	24	87	2.69E+00	6.46E-01	9.31E-02	9.03E-02	9.31E-03	0.00E+00	2.69E+00	0.00E+00	5.66E-01	9.31E-02	9.03E-02	0.00E+00	6.21E-03	9.31E-03
OV6AT1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	2	7	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	2.40E-01	0.00E+00	5.89E-02	7.37E-03	6.34E-04	6.14E-04	1.43E-04	4.75E-05	1.19E-05
OV6AM1	9.00	0.15	17.71	897.00	1.91	0.47	0.06	0.06	0.00	24	87	2.40E-01	5.89E-02	7.61E-03	7.37E-03	1.43E-04	0.00E+00	2.40E-01	0.00E+00	5.16E-02	7.61E-03	7.37E-03	0.00E+00	9.51E-05	1.43E-04
OV7T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	33	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
OV7M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	24	785	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	2.58E-02	2.50E-02	0.00E+00	3.33E-04	4.99E-04
OV7AT1	6.00	0.06	8.86	555.00	0.51	0.12	0.02	0.02	0.00	2	33	6.46E-02	1.54E-02	1.99E-03	1.93E-03	3.73E-05	6.46E-02	0.00E+00	1.54E-02	1.93E-03	1.66E-04	1.61E-04	3.73E-05	1.24E-05	3.11E-06
OV7AM1	6.00	0.06	8.86	555.00	0.51	0.12	0.02	0.02	0.00	24	785	6.46E-02	1.54E-02	1.99E-03	1.93E-03	3.73E-05	0.00E+00	6.46E-02	0.00E+00	1.35E-02	1.99E-03	1.93E-03	0.00E+00	2.49E-05	3.73E-05
OV8T1	43.00	0.60	27.59	879.00	86.26	19.78	2.67	2.58	0.11	2	15	1.09E+01	2.49E+00	3.36E-01	3.25E-01	1.41E-02	1.09E+01	0.00E+00	2.49E+00	3.12E-01	2.80E-02	2.71E-02	1.41E-02	4.70E-03	1.17E-03
OV8M1	43.00	0.60	6.65	879.00	20.79	4.77	0.64	0.62	0.03	1	245	2.62E+00	6.01E-01	8.09E-02	7.83E-02	3.39E-03	0.00E+00	2.62E+00	0.00E+00	5.25E-01	3.37E-03	3.26E-03	0.00E+00	2.26E-03	1.41E-04
OV8AT1	43.00	0.20	44.51	750.00	21.90	4.70	0.61	0.59	0.01	2	15	2.76E+00	5.92E-01	7.64E-02	7.41E-02	1.43E-03	2.76E+00	0.00E+00	5.92E-01	7.41E-02	6.37E-03	6.17E-03	1.43E-03	4.78E-04	1.19E-04
OV8AM1	43.00	0.20	44.51	750.00	21.90	4.70	0.61	0.59	0.01	1	245	2.76E+00	5.92E-01	7.64E-02	7.41E-02	1.43E-03	0.00E+00	2.76E+00	0.00E+00	5.18E-01	3.19E-03	3.09E-03	0.00E+00	9.56E-04	5.97E-05
OD1	53.00	0.10	105.60	844.00	0.53	4.63	0.04	0.04	0.01	24	1000	6.67E-02	5.83E-01	5.00E-03	5.00E-03	1.13E-03	6.67E-02	6.67E-02	5.83E-01	5.83E-01	5.00E-03	5.00E-03	1.13E-03	1.13E-03	1.13E-03
IV1T1	28.00	0.33	83.66	555.00	91.17	21.13	3.27	3.17	0.82	2	19	1.15E+01	2.66E+00	4.12E-01	3.99E-01	1.03E-01	1.15E+01	0.00E+00	2.66E+00	3.33E-01	3.43E-02	3.33E-02	1.03E-01	3.43E-02	8.57E-03
IV1M1	28.00	0.33	20.16	555.00	21.97	5.09	0.79	0.76	0.20	24	1421	2.77E+00	6.42E-01	9.92E-02	9.63E-02	2.48E-02	0.00E+00	2.77E+00	0.00E+00	5.61E-01	9.92E-02	9.63E-02	0.00E+00	1.65E-02	2.48E-02
IV1AT1	28.00	0.33	42.83	555.00	21.37	5.36	0.69	0.67	0.01	2	19	2.69E+00	6.75E-01	8.71E-02	8.44E-02	1.63E-03	2.69E+00	0.00E+00	6.75E-01	8.44E-02	7.26E-03	7.03E-03	1.63E-03	5.44E-04	1.36E-04
IV1AM1	28.00	0.33	42.83	555.00	21.37	5.36	0.69	0.67	0.01	24	1421	2.69E+00	6.75E-01	8.71E-02	8.44E-02	1.63E-03	0.00E+00	2.69E+00	0.00E+00	5.91E-01	8.71E-02	8.44E-02	0.00E+00	1.09E-03	1.63E-03
IV2T1	16.00	0.33	38.51	555.00	28.06	6.75	0.97	0.94	0.10	2	7	3.54E+00	8.51E-01	1.23E-01	1.19E-01	1.23E-02	3.54E+00	0.00E+00	8.51E-01	1.06E-01	1.02E-02	9.90E-03	1.23E-02	4.09E-03	1.02E-03
IV2M1	16.00	0.33	9.28	555.00	6.76	1.63	0.23	0.23	0.02	12	124	8.52E-01	2.05E-01	2.95E-02	2.86E-02	2.95E-03	0.00E+00	8.52E-01	0.00E+00	1.79E-01	1.48E-02	1.43E-02	0.00E+00	1.97E-03	1.48E-03
IV2AT1	16.00	0.15	9.46	555.00	2.36	0.58	0.07	0.07	0.00	2	7	2.97E-01	7.29E-02	9.40E-03	9.11E-03	1.76E-04	2.97E-01	0.00E+00	7.29E-02	9.11E-03	7.84E-04	7.59E-04	1.76E-04	5.88E-05	1.47E-05
IV2AM1	16.00	0.15	9.46	555.00	2.36	0.58	0.07	0.07	0.00	12	124	2.97E-01	7.29E-02	9.40E-03	9.11E-03	1.76E-04	0.00E+00	2.97E-01	0.00E+00	6.38E-02	4.70E-03	4.55E-03	0.00E+00	1.18E-04	8.82E-05
IV3T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	178	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
IV3M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	12	1636	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	1.29E-02	1.25E-02	0.00E+00	3.33E-04	2.50E-04
IV3AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	178	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
IV3AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	12	1636	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	7.64E-04	7.41E-04	0.00E+00	1.91E-05	1.43E-05
IV4T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	178	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
IV4M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	12	1636	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	1.29E-02	1.25E-02	0.00E+00	3.33E-04	2.50E-04
IV4AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	178	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
IV4AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	12	1636	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	7.64E-04	7.41E-04	0.00E+00	1.91E-05	1.43E-05
IV5T1	43.00	0.67	32.33	555.00	260.47	60.38	9.33	9.06	2.33	2	7	3.28E+01	7.61E+00	1.18E+00	1.14E+00	2.94E-01	3.28E+01	0.00E+00	7.61E+00	9.51E-01	9.80E-02	9.51E-02	2.94E-01	9.80E-02	2.45E-02
IV5M1	43.00	0.67	7.79	555.00	62.76	14.55	2.25	2.18	0.56	24	1418	7.91E+00	1.83E+00	2.83E-01	2.75E-01	7.08E-02	0.00E+00	7.91E+00	0.00E+00	1.60E+00	2.83E-01	2.75E-01	0.00E+00	4.72E-02	7.08E-02
IV5AT1	43.00	0.67	10.28	555.00	17.66	4.43	0.57	0.55	0.01	2	7	2.23E+00	5.58E-01	7.20E-02	6.98E-02	1.35E-03	0.00E+00	0.00E+00	0.00E+00	6.98E-02	6.00E-03	5.81E-03	0.00E+00	4.50E-04	1.13E-04
IV5AM1	43.00	0.67	10.28	555.00	29.43	7.38	0.95	0.92	0.02	24	1418	3.71E+00	9.30E-01	1.20E-01	1.16E-01	2.25E-03	3.71E+00	3.71E+00	9.30E-01	8.14E-01	1.20E-01	1.16E-01	2.25E-03	1.50E-03	2.25E-03
IV6T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	11	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
IV6M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	24	327	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	2.58E-02	2.50E-02	0.00E+00	3.33E-04	4.99E-04
IV6AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	11	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
IV6AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	24	327	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	1.53E-03	1.48E-03	0.00E+00	1.91E-05	2.87E-05
ECV1T1	28.00	0.33	83.66	555.00	91.17	21.13	3.27	3.17	0.82	2	6	1.15E+01	2.66E+00	4.12E-01	3.99E-01	1.03E-01	1.15E+01	0.00E+00	2.66E+00	3.33E-01	3.43E-02	3.33E-02	1.03E-01	3.43E-02	8.57E-03
ECV1M1	28.00	0.33	20.16	555.00	21.97	5.09	0.79	0.76	0.20	24	1309	2.77E+00	6.42E-01	9.92E-02	9.63E-02	2.48E-02	0.00E+00	2.77E+00	0.00E+00	5.61E-01	9.92E-02	9.63E-02	0.00E+00	1.65E-02	2.48E-02
ECV1AT1	28.00	0.33	42.83	555.00	21.37	5.36	0.69	0.67	0.01	2	6	2.69E+00	6.75E-01	8.71E-02	8.44E-02	1.63E-03	2.69E+00	0.00E+00	6.75E-01	8.44E-02	7.26E-03	7.03E-03	1.63E-03	5.44E-04	1.36E-04
ECV1AM1	28.00	0.33	42.83	555.00	21.37	5.36	0.69	0.67	0.01	24	1309	2.69E+00	6.75E-01	8.71E-02	8.44E-02	1.63E-03	0.00E+00	2.69E+00	0.00E+00	5.91E-01	8.71E-02	8.44E-02	0.00E+00	1.09E-03	1.63E-03
ECV2T1	16.00	0.33	38.51	555.00	27.97	6.49	1.00	0.97	0.25	2	14	3.52E+00	8.17E-01	1.26E-01	1.23E-01	3.16E-02	3.52E+00	0.00E+00	8.17E-01	1.02E-01	1.05E-02	1.02E-02	3.16E-02	1.05E-02	2.63E-03
ECV2M1	16.00	0.33	9.28	555.00	6.74	1.56	0.24	0.23	0.06	24	436	8.49E-01	1.97E-01	3.04E-02	2.95E-02	7.61E-03	0.00E+00	8.49E-01	0.00E+00	1.72E-01	3.04E-02	2.95E-02	0.00E+00	5.07E-03	7.61E-03
ECV2AT1	16.00	0.15	9.46	555.00	2.31	0.58	0.07	0.07	0.00	2	14	2.91E-01	7.29E-02	9.40E-03	9.11E-03	1.76E-04	2.91E-01	0.00E+00	7.29E-02	9.11E-03	7.84E-04	7.59E-04	1.76E-04	5.88E-05	1.47E-05
ECV2AM1	16.00	0.15	9.46	555.00	2.31	0.58	0.07	0.07	0.00	24	436	2.91E-01	7.29E-02	9.40E-03	9.11E-03	1.76E-04	0.00E+00	2.91E-01	0.00E+00	6.38E-02	9.40E-03	9.11E-03	0.00E+00	1.18E-04	1.76E-04
ECV3T1	43.00	0.67	32.33	555.00	260.47	60.38	9.33	9.06	2.33	2	7	3.28E+01	7.61E+00	1.18E+00	1.14E+00	2.94E-01	3.28E+01	0.00E+00	7.61E+00	9.51E-01	9.80E-02	9.51E-02	2.94E-01	9.80E-02	2.45E-02
ECV3M1	43.00	0.67	7.79	555.00	62.76	14.55	2.25	2.18	0.56	24	1309	7.91E+00	1.83E+00	2.83E-01	2.75E-01	7.08E-02	0.00E+00	7.91E+00	0.00E+00	1.60E+00	2.83E-01	2.75E-01	0.00E+00	4.72E-02	7.08E-02
ECV3AT1	43.00	0.67	10.28	555.00	17.66	4.43	0.57	0.55	0.01	2	7	2.23E+00	5.58E-01	7.20E-02	6.98E-02	1.35E-03	0.00E+00	0.00E+00	0.00E+00	6.98E-02	6.00E-03	5.81E-03	0.00E+00	4.50E-04	1.13E-04
ECV3AM1	43.00	0.67	10.28	555.00	29.43	7.38	0.95	0.92	0.02	24	1309	3.71E+00	9.30E-01	1.20E-01	1.16E-01	2.25E-03	3.71E+00	3.71E+00	9.30E-01	8.14E-01	1.20E-01	1.16E-01	2.25E-03	1.50E-03	2.25E-03
ECV4T1	43.00	0.60	27.59	879.00	86.26	19.78	2.67	2.58	0.11	2	15	1.09E+01	2.49E+00	3.36E-01	3.25E-01	1.41E-02	1.09E+01	0.00E+00	2.49E+00	3.12E-01	2.80E-02	2.71E-02	1.41E-02	4.70E-03	1.17E-03
ECV4M1	43.00	0.60	6.65	879.00	0.00	0.00	0.00	0.00	0.00	12	305	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ECV4AT1	43.00	0.20	44.51	750.00	21.90	4.70	0.61	0.59	0.01	2	15	2.76E+00	5.92E-01	7.64E-02	7.41E-02	1.43E-03	2.76E+00	0.00E+00	5.92E-01	7.41E-02	6.37E-03	6.17E-03	1.43E-03	4.78E-04	1.19E-04
ECV4AM1	43.00	0.20	44.51	750.00	21.90	4.70	0.61	0.59	0.01	12	305	2.76E+00	5.92E-01	7.64E-02	7.41E-02	1.43E-03	0.00E+00	2.76E+00	0.00E+00	5.18E-01	3.82E-02	3.70E-02	0.00E+00	9.56E-04	7.17E-04
ECV5T1	7.60	0.20	60.18	664.00	14.14	3.23	0.49	0.47	0.09	2	6	1.78E+00	4.07E-01	6.15E-02	5.96E-02	1.19E-02	1.78E+00	0.00E+00	4.07E-01	5.08E-02	5.12E-03	4.97E-03	1.19E-02	3.98E-03	9.94E-04
ECV5M1	7.60	0.20	14.50	664.00	3.41	0.78	0.12	0.11	0.02	12	305	4.29E-01	9.80E-02	1.48E-02	1.44E-02	2.87E-03	0.00E+00	4.29E-01	0.00E+00	8.58E-02	7.40E-03	7.19E-03	0.00E+00	1.92E-03	1.44E-03
ECV5AT1	7.60	0.15	13.31	712.00	2.61	0.63	0.08	0.08	0.00	2	6	3.29E-01	8.00E-02	1.03E-02	1.00E-02	1.94E-04	3.29E-01	0.00E+00	8.00E-02	1.00E-02	8.60E-04	8.33E-04	1.94E-04	6.45E-05	1.61E-05
ECV5AM1	7.60	0.15	13.31	712.00	2.61	0.63	0.08	0.08	0.00	12	305	3.29E-01	8.00E-02	1.03E-02	1.00E-02	1.94E-04	0.00E+00	3.29E-01	0.00E+00	7.00E-02	5.16E-03	5.00E-03	0.00E+00	1.29E-04	9.68E-05
ECV6T1	16.00	0.33	38.51	555.00	27.97	6.49	1.00	0.97	0.25	2	85	3.52E+00	8.17E-01	1.26E-01	1.23E-01	3.16E-02	3.52E+00	0.00E+00	8.17E-01	1.02E-01	1.05E-02	1.02E-02	3.16E-02	1.05E-02	2.63E-03
ECV6M1	16.00	0.33	9.28	555.00	6.74	1.56	0.24	0.23	0.06	12	305	8.49E-01	1.97E-01	3.04E-02	2.95E-02	7.61E-03	0.00E+00	8.49E-01	0.00E+00	1.72E-01	1.52E-02	1.48E-02	0.00E+00	5.07E-03	3.80E-03
ECV6AT1	16.00	0.15	9.46	555.00	2.31	0.58	0.07	0.07	0.00	2	85	2.91E-01	7.29E-02	9.40E-03	9.11E-03	1.76E-04	2.91E-01	0.00E+00	7.29E-02	9.11E-03	7.84E-04	7.59E-04	1.76E-04	5.88E-05	1.47E-05
ECV6AM1	16.00	0.15	9.46	555.00	2.31	0.58	0.07	0.07	0.00	12	305	2.91E-01	7.29E-02	9.40E-03	9.11E-03	1.76E-04	0.00E+00	2.91E-01	0.00E+00	6.38E-02	4.70E-03	4.55E-03	0.00E+00	1.18E-04	8.82E-05
OMV1T1	33.00	1.01	15.91	555.00	234.43	54.35	8.40	8.15	2.10	2	1	2.95E+01	6.85E+00	1.06E+00	1.03E+00	2.65E-01	2.95E+01	0.00E+00	6.85E+00	8.56E-01	8.82E-02	8.56E-02	2.65E-01	8.82E-02	2.20E-02
OMV1M1	33.00	1.01	3.83	555.00	56.49	13.10	2.02	1.96	0.51	24	1	7.12E+00	1.65E+00	2.55E-01	2.48E-01	6.38E-02	0.00E+00	7.12E+00	0.00E+00	1.44E+00	2.55E-01	2.48E-01	0.00E+00	4.25E-02	6.38E-02
OMV1AT1	33.00	1.65	0.26	555.00	2.90	0.73	0.09	0.09	0.00	2	1	3.65E-01	9.15E-02	1.18E-02	1.14E-02	2.21E-04	0.00E+00	0.00E+00	0.00E+00	1.14E-02	9.84E-04	9.53E-04	0.00E+00	7.38E-05	1.85E-05
OMV1AM1	33.00	1.65	0.63	555.00	11.77	2.95	0.38	0.37	0.01	24	1	1.48E+00	3.72E-01	4.80E-02	4.65E-02	9.00E-04	1.48E+00	1.48E+00	3.72E-01	3.26E-01	4.80E-02	4.65E-02	9.00E-04	6.00E-04	9.00E-04
OMV2T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	0	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
OMV2M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	24	5	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	2.58E-02	2.50E-02	0.00E+00	3.33E-04	4.99E-04

Stack Parameters and Operations												Maximum Hourly Emissions					1-Hour NO2 (Max of Transit or Manuvering)	1-Hour NO2 (Manuvering Only)	1-Hour CO	8-hour CO	24-Hour PM10	24-Hour PM25	1-Hour SO2	3-Hour SO2	24-Hour SO2
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	Daily Operation Hours	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	NOx (g/s)	NOx (g/s)	CO (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	SO2 (g/s)	SO2 (g/s)
OMV2AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	2	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
OMV2AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	24	5	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	1.53E-03	1.48E-03	0.00E+00	1.91E-05	2.87E-05
OMV3T1	43.00	0.60	27.59	879.00	86.26	19.78	2.67	2.58	0.11	2	2	1.09E+01	2.49E+00	3.36E-01	3.25E-01	1.41E-02	1.09E+01	0.00E+00	2.49E+00	3.12E-01	2.80E-02	2.71E-02	1.41E-02	4.70E-03	1.17E-03
OMV3M1	43.00	0.60	6.65	879.00	0.00	0.00	0.00	0.00	0.00	24	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OMV3AT1	43.00	0.20	44.51	750.00	21.90	4.70	0.61	0.59	0.01	2	1	2.76E+00	5.92E-01	7.64E-02	7.41E-02	1.43E-03	2.76E+00	0.00E+00	5.92E-01	7.41E-02	6.37E-03	6.17E-03	1.43E-03	4.78E-04	1.19E-04
OMV3AM1	43.00	0.20	44.51	750.00	21.90	4.70	0.61	0.59	0.01	24	19	2.76E+00	5.92E-01	7.64E-02	7.41E-02	1.43E-03	0.00E+00	2.76E+00	0.00E+00	5.18E-01	7.64E-02	7.41E-02	0.00E+00	9.56E-04	1.43E-03
OMV4T1	7.60	0.20	60.18	664.00	14.14	3.23	0.49	0.47	0.09	2	1	1.78E+00	4.07E-01	6.15E-02	5.96E-02	1.19E-02	1.78E+00	0.00E+00	4.07E-01	5.08E-02	5.12E-03	4.97E-03	1.19E-02	3.98E-03	9.94E-04
OMV4M1	7.60	0.20	14.50	664.00	3.41	0.78	0.12	0.11	0.02	24	19	4.29E-01	9.80E-02	1.48E-02	1.44E-02	2.87E-03	0.00E+00	4.29E-01	0.00E+00	8.58E-02	1.48E-02	1.44E-02	0.00E+00	1.92E-03	2.87E-03
OMV4AT1	7.60	0.15	13.31	712.00	2.61	0.63	0.08	0.08	0.00	2	4	3.29E-01	8.00E-02	1.03E-02	1.00E-02	1.94E-04	3.29E-01	0.00E+00	8.00E-02	1.00E-02	8.60E-04	8.33E-04	1.94E-04	6.45E-05	1.61E-05
OMV4AM1	7.60	0.15	13.31	712.00	2.61	0.63	0.08	0.08	0.00	24	7	3.29E-01	8.00E-02	1.03E-02	1.00E-02	1.94E-04	0.00E+00	3.29E-01	0.00E+00	7.00E-02	1.03E-02	1.00E-02	0.00E+00	1.29E-04	1.94E-04
OMV5T1	7.60	0.20	60.18	664.00	14.14	3.23	0.49	0.47	0.09	2	4	1.78E+00	4.07E-01	6.15E-02	5.96E-02	1.19E-02	1.78E+00	0.00E+00	4.07E-01	5.08E-02	5.12E-03	4.97E-03	1.19E-02	3.98E-03	9.94E-04
OMV5M1	7.60	0.20	14.50	664.00	3.41	0.78	0.12	0.11	0.02	24	7	4.29E-01	9.80E-02	1.48E-02	1.44E-02	2.87E-03	0.00E+00	4.29E-01	0.00E+00	8.58E-02	1.48E-02	1.44E-02	0.00E+00	1.92E-03	2.87E-03
OMV5AT1	7.60	0.15	13.31	712.00	2.61	0.63	0.08	0.08	0.00	2	0	3.29E-01	8.00E-02	1.03E-02	1.00E-02	1.94E-04	3.29E-01	0.00E+00	8.00E-02	1.00E-02	8.60E-04	8.33E-04	1.94E-04	6.45E-05	1.61E-05
OMV5AM1	7.60	0.15	13.31	712.00	2.61	0.63	0.08	0.08	0.00	24	2	3.29E-01	8.00E-02	1.03E-02	1.00E-02	1.94E-04	0.00E+00	3.29E-01	0.00E+00	7.00E-02	1.03E-02	1.00E-02	0.00E+00	1.29E-04	1.94E-04
OMV6T1	6.00	0.46	18.36	555.00	4.93	6.30	0.11	0.11	0.02	2	8	6.22E-01	7.94E-01	1.38E-02	1.38E-02	2.07E-03	6.22E-01	0.00E+00	7.94E-01	9.93E-02	1.15E-03	1.15E-03	2.07E-03	6.91E-04	1.73E-04
OMV6M1	6.00	0.46	4.42	555.00	1.19	1.52	0.03	0.03	0.00	24	2	1.50E-01	1.91E-01	3.33E-03	3.33E-03	4.99E-04	0.00E+00	1.50E-01	0.00E+00	1.67E-01	3.33E-03	3.33E-03	0.00E+00	3.33E-04	4.99E-04
OMV6AT1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	2	8	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	2.77E-02	0.00E+00	1.18E-02	1.48E-03	5.97E-05	5.97E-05	2.87E-05	9.56E-06	2.39E-06
OMV6AM1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	24	0	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	0.00E+00	2.77E-02	0.00E+00	1.04E-02	7.17E-04	7.17E-04	0.00E+00	1.91E-05	2.87E-05
OMV7T1	6.00	0.46	18.36	555.00	4.93	6.30	0.11	0.11	0.02	2	82	6.22E-01	7.94E-01	1.38E-02	1.38E-02	2.07E-03	6.22E-01	0.00E+00	7.94E-01	9.93E-02	1.15E-03	1.15E-03	2.07E-03	6.91E-04	1.73E-04
OMV7M1	6.00	0.46	4.42	555.00	1.19	1.52	0.03	0.03	0.00	24	760	1.50E-01	1.91E-01	3.33E-03	3.33E-03	4.99E-04	0.00E+00	1.50E-01	0.00E+00	1.67E-01	3.33E-03	3.33E-03	0.00E+00	3.33E-04	4.99E-04
OMV7AT1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	2	82	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	2.77E-02	0.00E+00	1.18E-02	1.48E-03	5.97E-05	5.97E-05	2.87E-05	9.56E-06	2.39E-06
OMV7AM1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	24	760	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	0.00E+00	2.77E-02	0.00E+00	1.04E-02	7.17E-04	7.17E-04	0.00E+00	1.91E-05	2.87E-05
OMV8T1	6.00	0.46	18.36	555.00	4.93	6.30	0.11	0.11	0.02	2	82	6.22E-01	7.94E-01	1.38E-02	1.38E-02	2.07E-03	6.22E-01	0.00E+00	7.94E-01	9.93E-02	1.15E-03	1.15E-03	2.07E-03	6.91E-04	1.73E-04
OMV8M1	6.00	0.46	4.42	555.00	1.19	1.52	0.03	0.03	0.00	24	760	1.50E-01	1.91E-01	3.33E-03	3.33E-03	4.99E-04	0.00E+00	1.50E-01	0.00E+00	1.67E-01	3.33E-03	3.33E-03	0.00E+00	3.33E-04	4.99E-04
OMV8AT1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	2	82	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	2.77E-02	0.00E+00	1.18E-02	1.48E-03	5.97E-05	5.97E-05	2.87E-05	9.56E-06	2.39E-06
OMV8AM1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	24	760	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	0.00E+00	2.77E-02	0.00E+00	1.04E-02	7.17E-04	7.17E-04	0.00E+00	1.91E-05	2.87E-05
OMV9T1	6.00	0.46	18.36	555.00	4.93	6.30	0.11	0.11	0.02	2	82	6.22E-01	7.94E-01	1.38E-02	1.38E-02	2.07E-03	6.22E-01	0.00E+00	7.94E-01	9.93E-02	1.15E-03	1.15E-03	2.07E-03	6.91E-04	1.73E-04
OMV9M1	6.00	0.46	4.42	555.00	1.19	1.52	0.03	0.03	0.00	24	760	1.50E-01	1.91E-01	3.33E-03	3.33E-03	4.99E-04	0.00E+00	1.50E-01	0.00E+00	1.67E-01	3.33E-03	3.33E-03	0.00E+00	3.33E-04	4.99E-04
OMV9AT1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	2	82	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	2.77E-02	0.00E+00	1.18E-02	1.48E-03	5.97E-05	5.97E-05	2.87E-05	9.56E-06	2.39E-06
OMV9AM1	6.00	0.06	8.86	555.00	0.22	0.09	0.01	0.01	0.00	24	760	2.77E-02	1.18E-02	7.17E-04	7.17E-04	2.87E-05	0.00E+00	2.77E-02	0.00E+00	1.04E-02	7.17E-04	7.17E-04	0.00E+00	1.91E-05	2.87E-05
OMV10T1	6.00	0.46	18.36	555.00	25.08	6.30	0.85	0.82	0.02	2	82	3.16E+00	7.94E-01	1.07E-01	1.04E-01	2.07E-03	3.16E+00	0.00E+00	7.94E-01	9.93E-02	8.92E-03	8.63E-03	2.07E-03	6.91E-04	1.73E-04
OMV10M1	6.00	0.46	4.42	555.00	6.04	1.52	0.20	0.20	0.00	24	760	7.61E-01	1.91E-01	2.58E-02	2.50E-02	4.99E-04	0.00E+00	7.61E-01	0.00E+00	1.67E-01	2.58E-02	2.50E-02	0.00E+00	3.33E-04	4.99E-04
OMV10AT1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	2	82	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	4.96E-02	0.00E+00	1.18E-02	1.48E-03	1.27E-04	1.23E-04	2.87E-05	9.56E-06	2.39E-06
OMV10AM1	6.00	0.06	8.86	555.00	0.39	0.09	0.01	0.01	0.00	24	760	4.96E-02	1.18E-02	1.53E-03	1.48E-03	2.87E-05	0.00E+00	4.96E-02	0.00E+00	1.04E-02	1.53E-03	1.48E-03	0.00E+00	1.91E-05	2.87E-05
OMD1	53.00	0.10	105.60	844.00	0.53	4.63	0.04	0.04	0.01	24	1000	6.67E-02	5.83E-01	5.00E-03	5.00E-03	1.13E-03	6.67E-02	6.67E-02	5.83E-01	5.83E-01	5.00E-03	5.00E-03	1.13E-03	1.13E-03	1.13E-03

Note: Refer to OCS Air Permit Application Section 5.5 for more detailed analysis and description.

For averaging periods longer than 1-hour, the maximum source operation time for any given mode of operation and construction or O&M activity will be modeled using the maximum hourly emissions rate that is scaled by the number of hours that source could be in operation by the number of hours in the averaging period.

Sample Calculation:

A description of the 24-hour PM2.5 calculation for a crew transfer vessel (AERMOD ID CV1) during WTG commissioning is as follows:

Main Engine (Transiting for 2 hours) = 1.645 lbs/24 hrs =0.00864 g/s over 24 hours.

Main Engine (Maneuvering for 12 hours) = 2.378 lbs/24 hrs =0.0125 g/s over 24 hours.

Auxiliary Engine (Transiting for 2 hours) = 0.0235 lbs/24 hrs =0.000123 g/s over 24 hours.

Auxiliary Engine (Maneuvering for 12 hours) = 0.141 lbs/24 hrs =0.00074 g/s over 24 hours.

Table A-43

US Wind, Inc. - Maryland Offshore Wind Project

AERMOD - Stack Parameters and Emissions - Construction Time Period

Stack Parameters					Maximum Annual Emissions - Year 2						Modeled Emissions				
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)
FV1T1	33.00	1.01	15.91	555.00	1.92	0.44	0.07	0.07	0.02	16	5.51E-02	1.28E-02	1.98E-03	1.92E-03	4.94E-04
FV1M1	33.00	1.01	3.83	555.00	28.65	6.64	1.03	1.00	0.26	1015	8.24E-01	1.91E-01	2.95E-02	2.87E-02	7.38E-03
FV1AT1	33.00	1.65	0.26	555.00	0.02	0.01	0.00	0.00	0.00	16	6.81E-04	1.71E-04	2.20E-05	2.14E-05	4.13E-07
FV1AM1	33.00	1.65	0.63	555.00	5.97	1.50	0.19	0.19	0.00	1015	1.72E-01	4.31E-02	5.56E-03	5.39E-03	1.04E-04
FV2T1	33.00	1.01	15.91	555.00	1.34	0.31	0.04	0.04	0.00	6	3.86E-02	8.84E-03	1.19E-03	1.15E-03	5.00E-05
FV2M1	33.00	1.01	5.13	555.00	46.41	10.64	1.43	1.39	0.06	1865	1.33E+00	3.06E-01	4.13E-02	3.99E-02	1.73E-03
FV2AT1	33.00	1.01	6.77	555.00	0.10	0.02	0.00	0.00	0.00	6	2.89E-03	6.20E-04	8.01E-05	7.76E-05	1.50E-06
FV2AM1	33.00	1.01	6.77	555.00	48.09	10.33	1.33	1.29	0.02	1865	1.38E+00	2.97E-01	3.83E-02	3.71E-02	7.19E-04
FV3T1	9.00	0.60	29.82	610.00	0.65	0.16	0.02	0.02	0.00	15	1.87E-02	4.51E-03	6.49E-04	6.30E-04	6.49E-05
FV3M1	9.00	0.60	4.95	610.00	9.94	2.39	0.34	0.33	0.03	933	2.86E-01	6.88E-02	9.92E-03	9.62E-03	9.92E-04
FV3AT1	9.00	0.15	17.71	897.00	0.01	0.00	0.00	0.00	0.00	15	4.03E-04	9.90E-05	1.28E-05	1.24E-05	2.40E-07
FV3AM1	9.00	0.15	17.71	897.00	0.89	0.22	0.03	0.03	0.00	933	2.56E-02	6.28E-03	8.10E-04	7.85E-04	1.52E-05
FV4T1	9.00	0.60	29.82	610.00	1.52	0.37	0.05	0.05	0.01	34	4.37E-02	1.05E-02	1.51E-03	1.47E-03	1.51E-04
FV4M1	9.00	0.60	4.95	610.00	2.75	0.66	0.10	0.09	0.01	258	7.90E-02	1.90E-02	2.74E-03	2.66E-03	2.74E-04
FV4AT1	9.00	0.15	17.71	897.00	0.03	0.01	0.00	0.00	0.00	34	9.41E-04	2.31E-04	2.98E-05	2.89E-05	5.59E-07
FV4AM1	9.00	0.15	17.71	897.00	0.25	0.06	0.01	0.01	0.00	258	7.06E-03	1.73E-03	2.24E-04	2.17E-04	4.20E-06
FV5T1	9.00	0.60	29.82	610.00	1.45	0.35	0.05	0.05	0.01	33	4.16E-02	1.00E-02	1.44E-03	1.40E-03	1.44E-04
FV5M1	9.00	0.60	4.95	610.00	2.62	0.63	0.09	0.09	0.01	245	7.53E-02	1.81E-02	2.61E-03	2.53E-03	2.61E-04
FV5AT1	9.00	0.15	17.71	897.00	0.03	0.01	0.00	0.00	0.00	33	8.96E-04	2.20E-04	2.84E-05	2.75E-05	5.32E-07
FV5AM1	9.00	0.15	17.71	897.00	0.23	0.06	0.01	0.01	0.00	245	6.73E-03	1.65E-03	2.13E-04	2.06E-04	4.00E-06
FV6T1	9.00	0.60	29.82	610.00	1.23	0.30	0.04	0.04	0.00	28	3.54E-02	8.51E-03	1.23E-03	1.19E-03	1.23E-04
FV6M1	9.00	0.60	4.95	610.00	2.22	0.54	0.08	0.07	0.01	209	6.40E-02	1.54E-02	2.22E-03	2.15E-03	2.22E-04
FV6AT1	9.00	0.15	17.71	897.00	0.03	0.01	0.00	0.00	0.00	28	7.62E-04	1.87E-04	2.41E-05	2.34E-05	4.53E-07
FV6AM1	9.00	0.15	17.71	897.00	0.20	0.05	0.01	0.01	0.00	209	5.72E-03	1.40E-03	1.81E-04	1.75E-04	3.40E-06
FV7T1	6.00	0.46	18.36	555.00	0.42	0.11	0.01	0.01	0.00	34	1.22E-02	3.06E-03	4.12E-04	3.99E-04	7.98E-06
FV7M1	6.00	0.46	4.42	555.00	0.78	0.20	0.03	0.03	0.00	259	2.25E-02	5.66E-03	7.63E-04	7.38E-04	1.48E-05
FV7AT1	6.00	0.06	8.86	555.00	0.01	0.00	0.00	0.00	0.00	34	1.91E-04	4.56E-05	5.89E-06	5.70E-06	1.10E-07
FV7AM1	6.00	0.06	8.86	555.00	0.05	0.01	0.00	0.00	0.00	259	1.47E-03	3.50E-04	4.52E-05	4.38E-05	8.48E-07
FV8T1	13.00	0.61	42.66	555.00	1.13	0.28	0.04	0.04	0.00	20	3.26E-02	8.20E-03	1.10E-03	1.07E-03	2.14E-05
FV8M1	13.00	0.61	10.28	555.00	6.23	1.57	0.21	0.20	0.00	466	1.79E-01	4.50E-02	6.07E-03	5.87E-03	1.17E-04
FV8AT1	13.00	0.25	1.77	555.00	0.09	0.02	0.00	0.00	0.00	20	2.72E-03	6.50E-04	8.39E-05	8.13E-05	1.57E-06
FV8AM1	13.00	0.25	11.47	555.00	3.60	0.86	0.11	0.11	0.00	466	1.04E-01	2.47E-02	3.19E-03	3.09E-03	5.98E-05
FV9T1	13.00	0.60	29.82	610.00	0.56	0.14	0.02	0.02	0.00	13	1.60E-02	4.02E-03	5.42E-04	5.25E-04	1.05E-05
FV9M1	13.00	0.60	4.95	610.00	4.78	1.20	0.16	0.16	0.00	466	1.37E-01	3.46E-02	4.66E-03	4.51E-03	9.01E-05
FV9AT1	13.00	0.15	23.06	897.00	0.02	0.00	0.00	0.00	0.00	13	4.80E-04	1.15E-04	1.48E-05	1.43E-05	2.77E-07
FV9AM1	13.00	0.15	23.06	897.00	0.60	0.14	0.02	0.02	0.00	466	1.71E-02	4.09E-03	5.27E-04	5.11E-04	9.89E-06
FV10T1	6.00	0.46	18.36	555.00	2.12	0.53	0.07	0.07	0.00	169	6.08E-02	1.53E-02	2.06E-03	1.99E-03	3.99E-05
FV10M1	6.00	0.46	4.42	555.00	0.94	0.24	0.03	0.03	0.00	311	2.70E-02	6.79E-03	9.16E-04	8.86E-04	1.77E-05
FV10AT1	6.00	0.06	8.86	555.00	0.03	0.01	0.00	0.00	0.00	169	9.56E-04	2.28E-04	2.94E-05	2.85E-05	5.52E-07
FV10AM1	6.00	0.06	8.86	555.00	0.06	0.01	0.00	0.00	0.00	311	1.76E-03	4.21E-04	5.43E-05	5.26E-05	1.02E-06
FV11T1	6.00	0.46	18.36	555.00	2.12	0.53	0.07	0.07	0.00	169	6.08E-02	1.53E-02	2.06E-03	1.99E-03	3.99E-05
FV11M1	6.00	0.46	4.42	555.00	0.94	0.24	0.03	0.03	0.00	311	2.70E-02	6.79E-03	9.16E-04	8.86E-04	1.77E-05
FV11AT1	6.00	0.06	8.86	555.00	0.03	0.01	0.00	0.00	0.00	169	9.56E-04	2.28E-04	2.94E-05	2.85E-05	5.52E-07
FV11AM1	6.00	0.06	8.86	555.00	0.06	0.01	0.00	0.00	0.00	311	1.76E-03	4.21E-04	5.43E-05	5.26E-05	1.02E-06

Stack Parameters					Maximum Annual Emissions - Year 2						Modeled Emissions				
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)
WV1T1	43.00	1.01	20.37	555.00	0.99	0.23	0.03	0.03	0.00	9	2.85E-02	6.53E-03	8.81E-04	8.52E-04	3.69E-05
WV1M1	43.00	1.01	2.41	555.00	0.00	0.00	0.00	0.00	0.00	4364	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WV1AT1	43.00	0.60	11.40	555.00	0.09	0.02	0.00	0.00	0.00	9	2.70E-03	5.79E-04	7.47E-05	7.24E-05	1.40E-06
WV1AM1	43.00	0.60	11.40	555.00	72.00	15.46	1.99	1.93	0.04	4364	2.07E+00	4.45E-01	5.74E-02	5.56E-02	1.08E-03
WV2T1	9.00	0.60	29.82	610.00	4.20	1.01	0.15	0.14	0.01	95	1.21E-01	2.90E-02	4.18E-03	4.06E-03	4.18E-04
WV2M1	9.00	0.60	4.95	610.00	10.12	2.43	0.35	0.34	0.04	949	2.91E-01	7.00E-02	1.01E-02	9.78E-03	1.01E-03
WV2AT1	9.00	0.15	17.71	897.00	0.09	0.02	0.00	0.00	0.00	95	2.60E-03	6.38E-04	8.23E-05	7.98E-05	1.54E-06
WV2AM1	9.00	0.15	17.71	897.00	0.90	0.22	0.03	0.03	0.00	949	2.60E-02	6.39E-03	8.24E-04	7.98E-04	1.55E-05
WV3T1	9.00	0.60	29.82	610.00	4.05	0.97	0.14	0.14	0.01	92	1.17E-01	2.80E-02	4.04E-03	3.92E-03	4.04E-04
WV3M1	9.00	0.60	4.95	610.00	9.77	2.35	0.34	0.33	0.03	916	2.81E-01	6.76E-02	9.74E-03	9.45E-03	9.74E-04
WV3AT1	9.00	0.15	17.71	897.00	0.09	0.02	0.00	0.00	0.00	92	2.51E-03	6.16E-04	7.95E-05	7.70E-05	1.49E-06
WV3AM1	9.00	0.15	17.71	897.00	0.87	0.21	0.03	0.03	0.00	916	2.51E-02	6.17E-03	7.96E-04	7.71E-04	1.49E-05
WV4T1	9.00	0.60	29.82	610.00	1.16	0.28	0.04	0.04	0.00	26	3.33E-02	8.01E-03	1.15E-03	1.12E-03	1.15E-04
WV4M1	9.00	0.60	4.95	610.00	46.52	11.19	1.61	1.56	0.16	4364	1.34E+00	3.22E-01	4.64E-02	4.50E-02	4.64E-03
WV4AT1	9.00	0.15	17.71	897.00	0.02	0.01	0.00	0.00	0.00	26	7.17E-04	1.76E-04	2.27E-05	2.20E-05	4.26E-07
WV4AM1	9.00	0.15	17.71	897.00	4.16	1.02	0.13	0.13	0.00	4364	1.20E-01	2.94E-02	3.79E-03	3.67E-03	7.10E-05
CV1T1	6.00	0.46	18.36	555.00	2.69	0.68	0.09	0.09	0.00	215	7.75E-02	1.95E-02	2.63E-03	2.54E-03	5.08E-05
CV1M1	6.00	0.46	4.42	555.00	6.15	1.55	0.21	0.20	0.00	2035	1.77E-01	4.45E-02	5.99E-03	5.80E-03	1.16E-04
CV1AT1	6.00	0.06	8.86	555.00	0.04	0.01	0.00	0.00	0.00	215	1.22E-03	2.91E-04	3.75E-05	3.63E-05	7.03E-07
CV1AM1	6.00	0.06	8.86	555.00	0.40	0.10	0.01	0.01	0.00	2035	1.15E-02	2.75E-03	3.55E-04	3.44E-04	6.66E-06
CV2T1	6.00	0.46	18.36	555.00	2.66	0.67	0.09	0.09	0.00	212	7.66E-02	1.93E-02	2.60E-03	2.51E-03	5.03E-05
CV2M1	6.00	0.46	4.42	555.00	6.08	1.53	0.21	0.20	0.00	2013	1.75E-01	4.40E-02	5.93E-03	5.74E-03	1.15E-04
CV2AT1	6.00	0.06	8.86	555.00	0.04	0.01	0.00	0.00	0.00	212	1.20E-03	2.87E-04	3.71E-05	3.59E-05	6.95E-07
CV2AM1	6.00	0.06	8.86	555.00	0.40	0.09	0.01	0.01	0.00	2013	1.14E-02	2.72E-03	3.51E-04	3.40E-04	6.59E-06
CV3T1	6.00	0.46	18.36	555.00	1.56	0.39	0.05	0.05	0.00	124	4.48E-02	1.13E-02	1.52E-03	1.47E-03	2.94E-05
CV3M1	6.00	0.46	4.42	555.00	3.63	0.91	0.12	0.12	0.00	1200	1.04E-01	2.62E-02	3.53E-03	3.42E-03	6.84E-05
CV3AT1	6.00	0.06	8.86	555.00	0.02	0.01	0.00	0.00	0.00	124	7.04E-04	1.68E-04	2.17E-05	2.10E-05	4.07E-07
CV3AM1	6.00	0.06	8.86	555.00	0.24	0.06	0.01	0.01	0.00	1200	6.80E-03	1.62E-03	2.09E-04	2.03E-04	3.93E-06
OV1T1	33.00	1.01	15.91	555.00	1.34	0.31	0.04	0.04	0.00	6	3.86E-02	8.84E-03	1.19E-03	1.15E-03	5.00E-05
OV1M1	33.00	1.01	5.13	555.00	7.60	1.74	0.23	0.23	0.01	305	2.19E-01	5.01E-02	6.76E-03	6.54E-03	2.83E-04
OV1AT1	33.00	1.01	5.18	555.00	0.10	0.02	0.00	0.00	0.00	6	2.89E-03	6.20E-04	8.01E-05	7.76E-05	1.50E-06
OV1AM1	33.00	1.01	8.63	555.00	7.88	1.69	0.22	0.21	0.00	305	2.27E-01	4.86E-02	6.28E-03	6.08E-03	1.18E-04
OV2T1	9.00	0.60	29.82	610.00	0.29	0.07	0.01	0.01	0.00	7	8.32E-03	2.00E-03	2.89E-04	2.80E-04	2.89E-05
OV2M1	9.00	0.60	4.95	610.00	3.26	0.78	0.11	0.11	0.01	305	9.37E-02	2.25E-02	3.25E-03	3.15E-03	3.25E-04
OV2AT1	9.00	0.15	17.71	897.00	0.01	0.00	0.00	0.00	0.00	7	1.79E-04	4.40E-05	5.68E-06	5.50E-06	1.06E-07
OV2AM1	9.00	0.15	17.71	897.00	0.29	0.07	0.01	0.01	0.00	305	8.37E-03	2.06E-03	2.65E-04	2.57E-04	4.97E-06
OV3T1	9.00	0.60	29.82	610.00	0.29	0.07	0.01	0.01	0.00	7	8.32E-03	2.00E-03	2.89E-04	2.80E-04	2.89E-05
OV3M1	9.00	0.60	4.95	610.00	2.33	0.56	0.08	0.08	0.01	218	6.69E-02	1.61E-02	2.32E-03	2.25E-03	2.32E-04
OV3AT1	9.00	0.15	23.06	897.00	0.01	0.00	0.00	0.00	0.00	7	2.33E-04	5.73E-05	7.40E-06	7.16E-06	1.39E-07
OV3AM1	9.00	0.15	23.06	897.00	0.27	0.07	0.01	0.01	0.00	218	7.79E-03	1.91E-03	2.47E-04	2.39E-04	4.63E-06
OV4T1	13.00	0.61	42.66	555.00	0.36	0.09	0.01	0.01	0.00	7	1.04E-02	2.62E-03	3.53E-04	3.42E-04	6.84E-06
OV4M1	13.00	0.61	10.28	555.00	0.58	0.15	0.02	0.02	0.00	44	1.68E-02	4.21E-03	5.68E-04	5.50E-04	1.10E-05
OV4AT1	13.00	0.25	1.77	555.00	0.03	0.01	0.00	0.00	0.00	7	8.71E-04	2.08E-04	2.68E-05	2.60E-05	5.03E-07
OV4AM1	13.00	0.25	11.47	555.00	0.34	0.08	0.01	0.01	0.00	44	9.68E-03	2.31E-03	2.98E-04	2.89E-04	5.59E-06
OV5T1	13.00	0.60	29.82	610.00	0.14	0.03	0.00	0.00	0.00	7	3.94E-03	9.90E-04	1.33E-04	1.29E-04	2.58E-06
OV5M1	13.00	0.60	4.95	610.00	0.22	0.06	0.01	0.01	0.00	44	6.33E-03	1.59E-03	2.14E-04	2.08E-04	4.15E-06
OV5AT1	13.00	0.15	23.06	897.00	0.01	0.00	0.00	0.00	0.00	7	2.40E-04	5.73E-05	7.40E-06	7.16E-06	1.39E-07
OV5AM1	13.00	0.15	23.06	897.00	0.06	0.01	0.00	0.00	0.00	44	1.60E-03	3.82E-04	4.93E-05	4.78E-05	9.25E-07
OV6T1	9.00	0.60	29.82	610.00	0.29	0.07	0.01	0.01	0.00	7	8.32E-03	2.00E-03	2.89E-04	2.80E-04	2.89E-05

Stack Parameters					Maximum Annual Emissions - Year 2						Modeled Emissions				
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)
OV6M1	9.00	0.60	4.95	610.00	0.93	0.22	0.03	0.03	0.00	87	2.68E-02	6.44E-03	9.28E-04	9.00E-04	9.28E-05
OV6AT1	9.00	0.15	17.71	897.00	0.01	0.00	0.00	0.00	0.00	7	1.79E-04	4.40E-05	5.68E-06	5.50E-06	1.06E-07
OV6AM1	9.00	0.15	17.71	897.00	0.08	0.02	0.00	0.00	0.00	87	2.39E-03	5.87E-04	7.58E-05	7.34E-05	1.42E-06
OV7T1	6.00	0.46	18.36	555.00	0.41	0.10	0.01	0.01	0.00	33	1.18E-02	2.97E-03	4.00E-04	3.87E-04	7.74E-06
OV7M1	6.00	0.46	4.42	555.00	2.37	0.60	0.08	0.08	0.00	785	6.83E-02	1.72E-02	2.31E-03	2.24E-03	4.48E-05
OV7AT1	6.00	0.06	8.86	555.00	0.01	0.00	0.00	0.00	0.00	33	2.42E-04	5.77E-05	7.44E-06	7.21E-06	1.39E-07
OV7AM1	6.00	0.06	8.86	555.00	0.20	0.05	0.01	0.01	0.00	785	5.80E-03	1.38E-03	1.79E-04	1.73E-04	3.35E-06
OV8T1	43.00	0.60	27.59	879.00	0.65	0.15	0.02	0.02	0.00	15	1.88E-02	4.31E-03	5.81E-04	5.62E-04	2.44E-05
OV8M1	43.00	0.60	6.65	879.00	2.55	0.58	0.08	0.08	0.00	245	7.34E-02	1.68E-02	2.27E-03	2.19E-03	9.51E-05
OV8AT1	43.00	0.20	44.51	750.00	0.17	0.04	0.00	0.00	0.00	15	4.77E-03	1.02E-03	1.32E-04	1.28E-04	2.48E-06
OV8AM1	43.00	0.20	44.51	750.00	2.69	0.58	0.07	0.07	0.00	245	7.73E-02	1.66E-02	2.14E-03	2.08E-03	4.02E-05
OD1	53.00	0.10	105.60	844.00	0.26	2.31	0.02	0.02	0.00	1000	7.61E-03	6.66E-02	5.71E-04	5.71E-04	1.29E-04
IV1T1	28.00	0.33	83.66	555.00	0.89	0.21	0.03	0.03	0.01	19	2.55E-02	5.92E-03	9.15E-04	8.88E-04	2.29E-04
IV1M1	28.00	0.33	20.16	555.00	15.61	3.62	0.56	0.54	0.14	1421	4.49E-01	1.04E-01	1.61E-02	1.56E-02	4.02E-03
IV1AT1	28.00	0.33	42.83	555.00	0.21	0.05	0.01	0.01	0.00	19	5.99E-03	1.50E-03	1.94E-04	1.88E-04	3.63E-06
IV1AM1	28.00	0.33	42.83	555.00	15.18	3.81	0.49	0.48	0.01	1421	4.37E-01	1.10E-01	1.41E-02	1.37E-02	2.65E-04
IV2T1	16.00	0.33	38.51	555.00	0.10	0.02	0.00	0.00	0.00	7	2.75E-03	6.62E-04	9.54E-05	9.25E-05	9.54E-06
IV2M1	16.00	0.33	9.28	555.00	0.42	0.10	0.01	0.01	0.00	124	1.21E-02	2.91E-03	4.19E-04	4.07E-04	4.19E-05
IV2AT1	16.00	0.15	9.46	555.00	0.01	0.00	0.00	0.00	0.00	7	2.31E-04	5.67E-05	7.32E-06	7.09E-06	1.37E-07
IV2AM1	16.00	0.15	9.46	555.00	0.15	0.04	0.00	0.00	0.00	124	4.21E-03	1.03E-03	1.33E-04	1.29E-04	2.50E-06
IV3T1	6.00	0.46	18.36	555.00	2.23	0.56	0.08	0.07	0.00	178	6.40E-02	1.61E-02	2.17E-03	2.10E-03	4.20E-05
IV3M1	6.00	0.46	4.42	555.00	4.94	1.24	0.17	0.16	0.00	1636	1.42E-01	3.58E-02	4.82E-03	4.66E-03	9.33E-05
IV3AT1	6.00	0.06	8.86	555.00	0.03	0.01	0.00	0.00	0.00	178	1.01E-03	2.40E-04	3.10E-05	3.00E-05	5.81E-07
IV3AM1	6.00	0.06	8.86	555.00	0.32	0.08	0.01	0.01	0.00	1636	9.27E-03	2.21E-03	2.86E-04	2.77E-04	5.35E-06
IV4T1	6.00	0.46	18.36	555.00	2.23	0.56	0.08	0.07	0.00	178	6.40E-02	1.61E-02	2.17E-03	2.10E-03	4.20E-05
IV4M1	6.00	0.46	4.42	555.00	4.94	1.24	0.17	0.16	0.00	1636	1.42E-01	3.58E-02	4.82E-03	4.66E-03	9.33E-05
IV4AT1	6.00	0.06	8.86	555.00	0.03	0.01	0.00	0.00	0.00	178	1.01E-03	2.40E-04	3.10E-05	3.00E-05	5.81E-07
IV4AM1	6.00	0.06	8.86	555.00	0.32	0.08	0.01	0.01	0.00	1636	9.27E-03	2.21E-03	2.86E-04	2.77E-04	5.35E-06
IV5T1	43.00	0.67	32.33	555.00	0.89	0.21	0.03	0.03	0.01	7	2.55E-02	5.92E-03	9.15E-04	8.88E-04	2.29E-04
IV5M1	43.00	0.67	7.79	555.00	44.51	10.32	1.59	1.55	0.40	1418	1.28E+00	2.97E-01	4.59E-02	4.45E-02	1.15E-02
IV5AT1	43.00	0.67	10.28	555.00	0.06	0.02	0.00	0.00	0.00	7	1.73E-03	4.34E-04	5.60E-05	5.43E-05	1.05E-06
IV5AM1	43.00	0.67	10.28	555.00	20.87	5.23	0.68	0.65	0.01	1418	6.00E-01	1.51E-01	1.94E-02	1.88E-02	3.64E-04
IV6T1	6.00	0.46	18.36	555.00	0.14	0.03	0.00	0.00	0.00	11	3.95E-03	9.94E-04	1.34E-04	1.30E-04	2.59E-06
IV6M1	6.00	0.46	4.42	555.00	0.99	0.25	0.03	0.03	0.00	327	2.84E-02	7.15E-03	9.64E-04	9.33E-04	1.87E-05
IV6AT1	6.00	0.06	8.86	555.00	0.00	0.00	0.00	0.00	0.00	11	6.21E-05	1.48E-05	1.91E-06	1.85E-06	3.59E-08
IV6AM1	6.00	0.06	8.86	555.00	0.06	0.02	0.00	0.00	0.00	327	1.85E-03	4.43E-04	5.71E-05	5.53E-05	1.07E-06
ECV1T1	28.00	0.33	83.66	555.00	0.30	0.07	0.01	0.01	0.00	6	8.51E-03	1.97E-03	3.05E-04	2.96E-04	7.63E-05
ECV1M1	28.00	0.33	20.16	555.00	14.38	3.33	0.52	0.50	0.13	1309	4.14E-01	9.59E-02	1.48E-02	1.44E-02	3.70E-03
ECV1AT1	28.00	0.33	42.83	555.00	0.07	0.02	0.00	0.00	0.00	6	2.00E-03	5.00E-04	6.46E-05	6.26E-05	1.21E-06
ECV1AM1	28.00	0.33	42.83	555.00	13.99	3.51	0.45	0.44	0.01	1309	4.02E-01	1.01E-01	1.30E-02	1.26E-02	2.44E-04
ECV2T1	16.00	0.33	38.51	555.00	0.19	0.04	0.01	0.01	0.00	14	5.49E-03	1.27E-03	1.97E-04	1.91E-04	4.91E-05
ECV2M1	16.00	0.33	9.28	555.00	1.47	0.34	0.05	0.05	0.01	436	4.23E-02	9.81E-03	1.52E-03	1.47E-03	3.79E-04
ECV2AT1	16.00	0.15	9.46	555.00	0.02	0.00	0.00	0.00	0.00	14	4.52E-04	1.13E-04	1.46E-05	1.42E-05	2.74E-07
ECV2AM1	16.00	0.15	9.46	555.00	0.50	0.13	0.02	0.02	0.00	436	1.45E-02	3.63E-03	4.68E-04	4.54E-04	8.78E-06
ECV3T1	43.00	0.67	32.33	555.00	0.89	0.21	0.03	0.03	0.01	7	2.55E-02	5.92E-03	9.15E-04	8.88E-04	2.29E-04
ECV3M1	43.00	0.67	7.79	555.00	41.08	9.52	1.47	1.43	0.37	1309	1.18E+00	2.74E-01	4.23E-02	4.11E-02	1.06E-02
ECV3AT1	43.00	0.67	10.28	555.00	0.06	0.02	0.00	0.00	0.00	7	1.73E-03	4.34E-04	5.60E-05	5.43E-05	1.05E-06
ECV3AM1	43.00	0.67	10.28	555.00	19.27	4.83	0.62	0.60	0.01	1309	5.54E-01	1.39E-01	1.79E-02	1.74E-02	3.36E-04
ECV4T1	43.00	0.60	27.59	879.00	0.65	0.15	0.02	0.02	0.00	15	1.88E-02	4.31E-03	5.81E-04	5.62E-04	2.44E-05

Stack Parameters					Maximum Annual Emissions - Year 2						Modeled Emissions				
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)
ECV4M1	43.00	0.60	6.65	879.00	0.00	0.00	0.00	0.00	0.00	305	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ECV4AT1	43.00	0.20	44.51	750.00	0.17	0.04	0.00	0.00	0.00	15	4.77E-03	1.02E-03	1.32E-04	1.28E-04	2.48E-06
ECV4AM1	43.00	0.20	44.51	750.00	3.34	0.72	0.09	0.09	0.00	305	9.62E-02	2.07E-02	2.67E-03	2.58E-03	5.00E-05
ECV5T1	7.60	0.20	60.18	664.00	0.04	0.01	0.00	0.00	0.00	6	1.23E-03	2.81E-04	4.25E-05	4.13E-05	8.25E-06
ECV5M1	7.60	0.20	14.50	664.00	0.52	0.12	0.02	0.02	0.00	305	1.50E-02	3.42E-03	5.16E-04	5.01E-04	1.00E-04
ECV5AT1	7.60	0.15	13.31	712.00	0.01	0.00	0.00	0.00	0.00	6	2.28E-04	5.53E-05	7.14E-06	6.92E-06	1.34E-07
ECV5AM1	7.60	0.15	13.31	712.00	0.40	0.10	0.01	0.01	0.00	305	1.15E-02	2.79E-03	3.60E-04	3.49E-04	6.75E-06
ECV6T1	16.00	0.33	38.51	555.00	1.19	0.28	0.04	0.04	0.01	85	3.41E-02	7.91E-03	1.22E-03	1.19E-03	3.06E-04
ECV6M1	16.00	0.33	9.28	555.00	1.03	0.24	0.04	0.04	0.01	305	2.96E-02	6.87E-03	1.06E-03	1.03E-03	2.65E-04
ECV6AT1	16.00	0.15	9.46	555.00	0.10	0.02	0.00	0.00	0.00	85	2.81E-03	7.06E-04	9.11E-05	8.82E-05	1.71E-06
ECV6AM1	16.00	0.15	9.46	555.00	0.35	0.09	0.01	0.01	0.00	305	1.01E-02	2.54E-03	3.28E-04	3.18E-04	6.15E-06
OMV1T1	33.00	1.01	15.91	555.00	0.43	0.10	0.02	0.02	0.00	1	2.17E-03	5.02E-04	7.77E-05	7.54E-05	1.94E-05
OMV1M1	33.00	1.01	3.83	555.00	0.19	0.04	0.01	0.01	0.00	1	9.48E-04	2.20E-04	3.39E-05	3.30E-05	8.49E-06
OMV1AT1	33.00	1.65	0.26	555.00	0.01	0.00	0.00	0.00	0.00	1	2.68E-05	6.71E-06	8.66E-07	8.39E-07	1.62E-08
OMV1AM1	33.00	1.65	0.63	555.00	0.04	0.01	0.00	0.00	0.00	1	1.98E-04	4.95E-05	6.39E-06	6.19E-06	1.20E-07
OMV2T1	6.00	0.46	18.36	555.00	0.33	0.08	0.01	0.01	0.00	0	1.63E-03	4.10E-04	5.52E-05	5.35E-05	1.07E-06
OMV2M1	6.00	0.46	4.42	555.00	0.03	0.01	0.00	0.00	0.00	5	1.45E-04	3.64E-05	4.91E-06	4.75E-06	9.50E-08
OMV2AT1	6.00	0.06	8.86	555.00	0.01	0.00	0.00	0.00	0.00	2	2.56E-05	6.11E-06	7.89E-07	7.64E-07	1.48E-08
OMV2AM1	6.00	0.06	8.86	555.00	0.00	0.00	0.00	0.00	0.00	5	9.44E-06	2.25E-06	2.91E-07	2.82E-07	5.45E-09
OMV3T1	43.00	0.60	27.59	879.00	0.36	0.08	0.01	0.01	0.00	2	1.79E-03	4.11E-04	5.55E-05	5.37E-05	2.33E-06
OMV3M1	43.00	0.60	6.65	879.00	0.00	0.00	0.00	0.00	0.00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OMV3AT1	43.00	0.20	44.51	750.00	0.09	0.02	0.00	0.00	0.00	1	4.56E-04	9.78E-05	1.26E-05	1.22E-05	2.37E-07
OMV3AM1	43.00	0.20	44.51	750.00	1.20	0.26	0.03	0.03	0.00	19	5.98E-03	1.28E-03	1.66E-04	1.61E-04	3.11E-06
OMV4T1	7.60	0.20	60.18	664.00	0.16	0.04	0.01	0.01	0.00	1	7.85E-04	1.79E-04	2.71E-05	2.63E-05	5.25E-06
OMV4M1	7.60	0.20	14.50	664.00	0.07	0.01	0.00	0.00	0.00	19	3.27E-04	7.46E-05	1.13E-05	1.09E-05	2.19E-06
OMV4AT1	7.60	0.15	13.31	712.00	0.03	0.01	0.00	0.00	0.00	4	1.45E-04	3.52E-05	4.54E-06	4.40E-06	8.52E-08
OMV4AM1	7.60	0.15	13.31	712.00	0.05	0.01	0.00	0.00	0.00	7	2.51E-04	6.08E-05	7.85E-06	7.61E-06	1.47E-07
OMV5T1	7.60	0.20	60.18	664.00	0.10	0.02	0.00	0.00	0.00	4	4.90E-04	1.12E-04	1.69E-05	1.64E-05	3.28E-06
OMV5M1	7.60	0.20	14.50	664.00	0.08	0.02	0.00	0.00	0.00	7	4.08E-04	9.32E-05	1.41E-05	1.37E-05	2.73E-06
OMV5AT1	7.60	0.15	13.31	712.00	0.02	0.00	0.00	0.00	0.00	0	9.06E-05	2.20E-05	2.84E-06	2.75E-06	5.32E-08
OMV5AM1	7.60	0.15	13.31	712.00	0.06	0.02	0.00	0.00	0.00	2	3.13E-04	7.61E-05	9.81E-06	9.51E-06	1.84E-07
OMV6T1	6.00	0.46	18.36	555.00	1.17	1.50	0.03	0.03	0.00	8	5.85E-03	7.48E-03	1.30E-04	1.30E-04	1.95E-05
OMV6M1	6.00	0.46	4.42	555.00	2.60	3.33	0.06	0.06	0.01	2	1.30E-02	1.66E-02	2.89E-04	2.89E-04	4.33E-05
OMV6AT1	6.00	0.06	8.86	555.00	0.05	0.02	0.00	0.00	0.00	8	2.61E-04	1.12E-04	6.75E-06	6.75E-06	2.70E-07
OMV6AM1	6.00	0.06	8.86	555.00	0.48	0.21	0.01	0.01	0.00	0	2.40E-03	1.03E-03	6.22E-05	6.22E-05	2.49E-06
OMV7T1	6.00	0.46	18.36	555.00	1.17	1.50	0.03	0.03	0.00	82	5.85E-03	7.48E-03	1.30E-04	1.30E-04	1.95E-05
OMV7M1	6.00	0.46	4.42	555.00	2.60	3.33	0.06	0.06	0.01	760	1.30E-02	1.66E-02	2.89E-04	2.89E-04	4.33E-05
OMV7AT1	6.00	0.06	8.86	555.00	0.05	0.02	0.00	0.00	0.00	82	2.61E-04	1.12E-04	6.75E-06	6.75E-06	2.70E-07
OMV7AM1	6.00	0.06	8.86	555.00	0.48	0.21	0.01	0.01	0.00	760	2.40E-03	1.03E-03	6.22E-05	6.22E-05	2.49E-06
OMV8T1	6.00	0.46	18.36	555.00	1.17	1.50	0.03	0.03	0.00	82	5.85E-03	7.48E-03	1.30E-04	1.30E-04	1.95E-05
OMV8M1	6.00	0.46	4.42	555.00	2.60	3.33	0.06	0.06	0.01	760	1.30E-02	1.66E-02	2.89E-04	2.89E-04	4.33E-05
OMV8AT1	6.00	0.06	8.86	555.00	0.05	0.02	0.00	0.00	0.00	82	2.61E-04	1.12E-04	6.75E-06	6.75E-06	2.70E-07
OMV8AM1	6.00	0.06	8.86	555.00	0.48	0.21	0.01	0.01	0.00	760	2.40E-03	1.03E-03	6.22E-05	6.22E-05	2.49E-06
OMV9T1	6.00	0.46	18.36	555.00	1.17	1.50	0.03	0.03	0.00	82	5.85E-03	7.48E-03	1.30E-04	1.30E-04	1.95E-05
OMV9M1	6.00	0.46	4.42	555.00	2.60	3.33	0.06	0.06	0.01	760	1.30E-02	1.66E-02	2.89E-04	2.89E-04	4.33E-05
OMV9AT1	6.00	0.06	8.86	555.00	0.05	0.02	0.00	0.00	0.00	82	2.61E-04	1.12E-04	6.75E-06	6.75E-06	2.70E-07
OMV9AM1	6.00	0.06	8.86	555.00	0.48	0.21	0.01	0.01	0.00	760	2.40E-03	1.03E-03	6.22E-05	6.22E-05	2.49E-06
OMV10T1	6.00	0.46	18.36	555.00	4.08	1.03	0.14	0.13	0.00	82	2.04E-02	5.12E-03	6.90E-04	6.68E-04	1.34E-05
OMV10M1	6.00	0.46	4.42	555.00	0.15	0.04	0.00	0.00	0.00	760	7.24E-04	1.82E-04	2.45E-05	2.37E-05	4.75E-07

Stack Parameters					Maximum Annual Emissions - Year 2						Modeled Emissions				
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Operating Hours Year 2	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)
OMV10AT1	6.00	0.06	8.86	555.00	0.06	0.02	0.00	0.00	0.00	82	3.20E-04	7.64E-05	9.86E-06	9.55E-06	1.85E-07
OMV10AM1	6.00	0.06	8.86	555.00	0.01	0.00	0.00	0.00	0.00	760	4.72E-05	1.13E-05	1.45E-06	1.41E-06	2.73E-08
OMD1	53.00	0.10	105.60	844.00	0.26	2.31	0.02	0.02	0.00	1000	1.32E-03	1.16E-02	9.91E-05	9.91E-05	2.25E-05

Note: Refer to OCS Air Permit Application Section 5.5 for more detailed analysis and description.

Table A-44
US Wind, Inc. - Maryland Offshore Wind Project
AERMOD - Stack Parameters and Emissions - Annual Operations and Maintenance

Stack Parameters					Maximum Annual Emissions						Modeled Emissions				
AERMOD ID	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	NOx (ton/year)	CO (ton/year)	PM10 (ton/year)	PM2.5 (ton/year)	SO2 (ton/year)	Annual Operation Hours	NOx (g/s)	CO (g/s)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)
OMV1T1	33.00	1.01	15.91	555.00	4.34E-01	1.01E-01	1.56E-02	1.51E-02	3.89E-03	4	1.25E-02	2.90E-03	4.47E-04	4.34E-04	1.12E-04
OMV1M1	33.00	1.01	3.83	555.00	1.90E-01	4.40E-02	6.80E-03	6.60E-03	1.70E-03	7	5.46E-03	1.27E-03	1.96E-04	1.90E-04	4.89E-05
OMV1AT1	33.00	1.65	0.26	555.00	5.36E-03	1.34E-03	1.74E-04	1.68E-04	3.25E-06	4	1.54E-04	3.87E-05	4.99E-06	4.84E-06	9.36E-08
OMV1AM1	33.00	1.65	0.63	555.00	3.96E-02	9.92E-03	1.28E-03	1.24E-03	2.40E-05	7	1.14E-03	2.85E-04	3.68E-05	3.57E-05	6.90E-07
OMV2T1	6.00	0.46	18.36	555.00	3.27E-01	8.21E-02	1.11E-02	1.07E-02	2.14E-04	26	9.39E-03	2.36E-03	3.18E-04	3.08E-04	6.16E-06
OMV2M1	6.00	0.46	4.42	555.00	2.90E-02	7.29E-03	9.83E-04	9.51E-04	1.90E-05	10	8.35E-04	2.10E-04	2.83E-05	2.74E-05	5.47E-07
OMV2AT1	6.00	0.06	8.86	555.00	5.13E-03	1.22E-03	1.58E-04	1.53E-04	2.96E-06	26	1.48E-04	3.52E-05	4.54E-06	4.40E-06	8.52E-08
OMV2AM1	6.00	0.06	8.86	555.00	1.89E-03	4.51E-04	5.82E-05	5.64E-05	1.09E-06	10	5.44E-05	1.30E-05	1.68E-06	1.62E-06	3.14E-08
OMV3T1	43.00	0.60	27.59	879.00	3.59E-01	8.24E-02	1.11E-02	1.08E-02	4.66E-04	8	1.03E-02	2.37E-03	3.20E-04	3.09E-04	1.34E-05
OMV3M1	43.00	0.60	6.65	879.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	109	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
OMV3AT1	43.00	0.20	44.51	750.00	9.12E-02	1.96E-02	2.53E-03	2.45E-03	4.74E-05	8	2.62E-03	5.64E-04	7.27E-05	7.04E-05	1.36E-06
OMV3AM1	43.00	0.20	44.51	750.00	1.20E+00	2.57E-01	3.32E-02	3.22E-02	6.22E-04	109	3.45E-02	7.40E-03	9.55E-04	9.25E-04	1.79E-05
OMV4T1	7.60	0.20	60.18	664.00	1.57E-01	3.59E-02	5.42E-03	5.26E-03	1.05E-03	22	4.52E-03	1.03E-03	1.56E-04	1.51E-04	3.03E-05
OMV4M1	7.60	0.20	14.50	664.00	6.54E-02	1.49E-02	2.26E-03	2.19E-03	4.38E-04	38	1.88E-03	4.30E-04	6.49E-05	6.30E-05	1.26E-05
OMV4AT1	7.60	0.15	13.31	712.00	2.90E-02	7.05E-03	9.10E-04	8.82E-04	1.71E-05	22	8.35E-04	2.03E-04	2.62E-05	2.54E-05	4.91E-07
OMV4AM1	7.60	0.15	13.31	712.00	5.02E-02	1.22E-02	1.57E-03	1.52E-03	2.95E-05	38	1.44E-03	3.51E-04	4.52E-05	4.38E-05	8.48E-07
OMV5T1	7.60	0.20	60.18	664.00	9.82E-02	2.24E-02	3.39E-03	3.29E-03	6.58E-04	14	2.83E-03	6.45E-04	9.74E-05	9.46E-05	1.89E-05
OMV5M1	7.60	0.20	14.50	664.00	8.18E-02	1.87E-02	2.82E-03	2.74E-03	5.48E-04	48	2.35E-03	5.37E-04	8.11E-05	7.88E-05	1.58E-05
OMV5AT1	7.60	0.15	13.31	712.00	1.81E-02	4.41E-03	5.69E-04	5.51E-04	1.07E-05	14	5.22E-04	1.27E-04	1.64E-05	1.59E-05	3.07E-07
OMV5AM1	7.60	0.15	13.31	712.00	6.27E-02	1.52E-02	1.97E-03	1.90E-03	3.69E-05	48	1.80E-03	4.38E-04	5.65E-05	5.48E-05	1.06E-06
OMV6T1	6.00	0.46	18.36	555.00	1.17E+00	1.50E+00	2.61E-02	2.61E-02	3.91E-03	475	3.37E-02	4.31E-02	7.49E-04	7.49E-04	1.12E-04
OMV6M1	6.00	0.46	4.42	555.00	2.60E+00	3.33E+00	5.79E-02	5.79E-02	8.68E-03	4,380	7.49E-02	9.57E-02	1.66E-03	1.66E-03	2.50E-04
OMV6AT1	6.00	0.06	8.86	555.00	5.23E-02	2.23E-02	1.35E-03	1.35E-03	5.41E-05	475	1.50E-03	6.43E-04	3.89E-05	3.89E-05	1.56E-06
OMV6AM1	6.00	0.06	8.86	555.00	4.82E-01	2.06E-01	1.25E-02	1.25E-02	4.98E-04	4,380	1.39E-02	5.92E-03	3.58E-04	3.58E-04	1.43E-05
OMV7T1	6.00	0.46	18.36	555.00	1.17E+00	1.50E+00	2.61E-02	2.61E-02	3.91E-03	475	3.37E-02	4.31E-02	7.49E-04	7.49E-04	1.12E-04
OMV7M1	6.00	0.46	4.42	555.00	2.60E+00	3.33E+00	5.79E-02	5.79E-02	8.68E-03	4,380	7.49E-02	9.57E-02	1.66E-03	1.66E-03	2.50E-04
OMV7AT1	6.00	0.06	8.86	555.00	5.23E-02	2.23E-02	1.35E-03	1.35E-03	5.41E-05	475	1.50E-03	6.43E-04	3.89E-05	3.89E-05	1.56E-06
OMV7AM1	6.00	0.06	8.86	555.00	4.82E-01	2.06E-01	1.25E-02	1.25E-02	4.98E-04	4,380	1.39E-02	5.92E-03	3.58E-04	3.58E-04	1.43E-05
OMV8T1	6.00	0.46	18.36	555.00	1.17E+00	1.50E+00	2.61E-02	2.61E-02	3.91E-03	475	3.37E-02	4.31E-02	7.49E-04	7.49E-04	1.12E-04
OMV8M1	6.00	0.46	4.42	555.00	2.60E+00	3.33E+00	5.79E-02	5.79E-02	8.68E-03	4,380	7.49E-02	9.57E-02	1.66E-03	1.66E-03	2.50E-04
OMV8AT1	6.00	0.06	8.86	555.00	5.23E-02	2.23E-02	1.35E-03	1.35E-03	5.41E-05	475	1.50E-03	6.43E-04	3.89E-05	3.89E-05	1.56E-06
OMV8AM1	6.00	0.06	8.86	555.00	4.82E-01	2.06E-01	1.25E-02	1.25E-02	4.98E-04	4,380	1.39E-02	5.92E-03	3.58E-04	3.58E-04	1.43E-05
OMV9T1	6.00	0.46	18.36	555.00	1.17E+00	1.50E+00	2.61E-02	2.61E-02	3.91E-03	475	3.37E-02	4.31E-02	7.49E-04	7.49E-04	1.12E-04
OMV9M1	6.00	0.46	4.42	555.00	2.60E+00	3.33E+00	5.79E-02	5.79E-02	8.68E-03	4,380	7.49E-02	9.57E-02	1.66E-03	1.66E-03	2.50E-04
OMV9AT1	6.00	0.06	8.86	555.00	5.23E-02	2.23E-02	1.35E-03	1.35E-03	5.41E-05	475	1.50E-03	6.43E-04	3.89E-05	3.89E-05	1.56E-06
OMV9AM1	6.00	0.06	8.86	555.00	4.82E-01	2.06E-01	1.25E-02	1.25E-02	4.98E-04	4,380	1.39E-02	5.92E-03	3.58E-04	3.58E-04	1.43E-05
OMV10T1	6.00	0.46	18.36	555.00	4.08E+00	1.03E+00	1.38E-01	1.34E-01	2.68E-03	325	1.17E-01	2.95E-02	3.98E-03	3.85E-03	7.70E-05
OMV10M1	6.00	0.46	4.42	555.00	1.45E-01	3.65E-02	4.91E-03	4.76E-03	9.51E-05	48	4.17E-03	1.05E-03	1.41E-04	1.37E-04	2.74E-06
OMV10AT1	6.00	0.06	8.86	555.00	6.41E-02	1.53E-02	1.97E-03	1.91E-03	3.70E-05	325	1.84E-03	4.40E-04	5.68E-05	5.50E-05	1.07E-06
OMV10AM1	6.00	0.06	8.86	555.00	9.46E-03	2.26E-03	2.91E-04	2.82E-04	5.46E-06	48	2.72E-04	6.49E-05	8.38E-06	8.12E-06	1.57E-07
OMD1	53.00	0.10	105.60	844.00	2.65E-01	2.31E+00	1.98E-02	1.98E-02	4.50E-03	1,000	7.61E-03	6.66E-02	5.71E-04	5.71E-04	1.29E-04

Note: Refer to OCS Air Permit Application Section 5.5 for more detailed analysis and description.

Table A-45
US Wind, Inc. - Maryland Offshore Wind Project
AERMOD - Modeled Vessels and Operating Scenarios

					Modeled Vessel Included in Scenario as Operating within Averaging Period (YES/NO)								
Activity	Representative Vessel Type	AERMOD ID	Engine Operation	Building Downwash Included	1-Hour NO2	1-Hour CO	8-hour CO	24-Hour PM10	24-Hour PM2.5	1-Hour SO2	3-Hour SO2	24-Hour SO2	Annual Average
Foundation Installation													
Scour protection installation vessel	Fallpipe vessel	FV1T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV1M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV1AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV1AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Foundation installation vessel	Heavy lift vessel	FV2T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV2M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV2AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV2AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Tug for assisting foundation installation 1 -- Offshore	Tug	FV3T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV3M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV3AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV3AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Foundation transport tug 1	Tug	FV4T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV4M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV4AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV4AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Foundation transport tug 2	Tug	FV5T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV5M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV5AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV5AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Foundation transport tug 3	Tug	FV6T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV6M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV6AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV6AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Crew transfer vessel 1	Crew transfer vessel	FV7T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV7M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV7AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		FV7AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Noise mitigation vessel	OSV	FV8T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV8M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV8AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV8AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Acoustic monitoring - buoy support vessel	OSV	FV9T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV9M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV9AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV9AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Marine mammal observation 1	Crew transfer vessel	FV10T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV10M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV10AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV10AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Environmental monitoring	Crew transfer vessel	FV11T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV11M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV11AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		FV11AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES

Activity	Representative Vessel Type	AERMOD ID	Engine Operation	Building Downwash Included	Modeled Vessel Included in Scenario as Operating within Averaging Period (YES/NO)								
					1-Hour NO2	1-Hour CO	8-hour CO	24-Hour PM10	24-Hour PM2.5	1-Hour SO2	3-Hour SO2	24-Hour SO2	Annual Average
Foundation Installation													
WTG Installation													
WTG installation jack-up vessel	Jack-up installation vessel	WV1T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		WV1M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		WV1AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		WV1AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Tug to transport WTG 1	Tug	WV2T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		WV2M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		WV2AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		WV2AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Tug to transport WTG 2	Tug	WV3T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		WV3M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		WV3AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		WV3AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Tug to support WTG Installation / maneuvering offshore	Tug	WV4T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		WV4M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		WV4AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		WV4AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
WTG Commissioning													
Crew transfer vessel 1	Crew transfer vessel	CV1T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV1M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV1AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV1AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Crew transfer vessel 2	Crew transfer vessel	CV2T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV2M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV2AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV2AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Crew transfer vessel 3	Crew transfer vessel	CV3T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV3M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV3AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		CV3AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
OSS Installation													
OSS installation	Heavy lift vessel	OV1T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV1M1	Main Engine - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV1AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV1AM1	Auxiliary Engines - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Assisting tug for OSS Jacket and topside install	Tug	OV2T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV2M1	Main Engine - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV2AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV2AM1	Auxiliary Engines - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
OSS Jacket and pilesTransport tug	Tug	OV3T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV3M1	Main Engine - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV3AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV3AM1	Auxiliary Engines - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
OSS Jacket Install Noise Mitigation Vessel	OSV	OV4T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV4M1	Main Engine - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV4AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV4AM1	Auxiliary Engines - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Acoustic monitoring buoy maint	OSV	OV5T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV5M1	Main Engine - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV5AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV5AM1	Auxiliary Engines - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
OSS Topside Transport (assume separate from Jacket/piles)	Tug	OV6T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OV6M1	Main Engine - Maneuvering	YES	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OV6AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OV6AM1	Auxiliary Engines - Maneuvering	YES	NO	YES	YES	NO	NO	YES	YES	YES	YES

					Modeled Vessel Included in Scenario as Operating within Averaging Period (YES/NO)								
Activity	Representative Vessel Type	AERMOD ID	Engine Operation	Building Downwash Included	1-Hour NO_2	1-Hour CO	8-hour CO	24-Hour PM_{10}	24-Hour $PM_{2.5}$	1-Hour SO_2	3-Hour SO_2	24-Hour SO_2	Annual Average
Foundation Installation													
Refueling operations to OSS and resupply to Hotel vessel	OSV	OV7T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV7M1	Main Engine - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV7AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV7AM1	Auxiliary Engines - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Crew Hotel Vessel	Jack-up vessel	OV8T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV8M1	Main Engine - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV8AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OV8AM1	Auxiliary Engines - Maneuvering	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Inter-Array Cable Installation													
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	IV1T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV1M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV1AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV1AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pre-lay grapnel run	Multipurpose offshore support vessel	IV2T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV2M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV2AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV2AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Crew transfer vessel 1	Crew transfer vessel	IV3T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV3M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV3AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV3AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Crew transfer vessel 2	Crew transfer vessel	IV4T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV4M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV4AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV4AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Trenching vessel	Purpose-built offshore construction/ROV/survey vessel	IV5T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV5M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV5AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV5AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Guard vessel	Crew transfer vessel	IV6T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV6M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV6AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		IV6AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Offshore Export Cable Installation													
Offshore export cable pre-lay survey, trenching, cable lay and pull	Cable lay vessel	ECV1T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV1M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV1AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV1AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pre-lay grapnel run & pre-lay survey; post lay survey after co	Multipurpose offshore support vessel	ECV2T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV2M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV2AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV2AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Trenching vessel	Purpose built offshore construction/survey vessel	ECV3T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV3M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV3AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV3AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
HDD pull in lift vessel	Jack-up vessel	ECV4T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV4M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV4AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV4AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Diving support for HDD pull in	Research / Survey	ECV5T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV5M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV5AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV5AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
HDD pull in support vessel	Multipurpose offshore support	ECV6T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES

Activity	Representative Vessel Type	AERMOD ID	Engine Operation	Building Downwash Included	Modeled Vessel Included in Scenario as Operating within Averaging Period (YES/NO)								
					1-Hour NO2	1-Hour CO	8-hour CO	24-Hour PM10	24-Hour PM2.5	1-Hour SO2	3-Hour SO2	24-Hour SO2	Annual Average
Foundation Installation													
	vessel	ECV6M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV6AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		ECV6AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Operations Phase													
Scour protection repair	Fallpipe vessel	OMV1T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV1M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV1AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV1AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Refueling operations to OSS	Crew transfer vessel	OMV2T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV2M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV2AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV2AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Main repair vessel	Jack-up vessel	OMV3T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV3M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV3AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV3AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Ad hoc survey workand cable survey/inspections	Multi-role survey vessel	OMV4T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV4M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV4AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV4AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cable burial repair	Multi-role survey vessel	OMV5T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV5M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV5AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV5AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Daily crew transfer vessel	Crew transfer vessel #1	OMV6T1	Main Engine - In Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV6M1	Main Engine - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV6AT1	Auxiliary Engines - Transit	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
		OMV6AM1	Auxiliary Engines - Maneuvering	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Daily crew transfer vessel	Crew transfer vessel #2	OMV7T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV7M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV7AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV7AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Daily crew transfer vessel	Crew transfer vessel #3	OMV8T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV8M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV8AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV8AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Daily crew transfer vessel	Crew transfer vessel #4	OMV9T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV9M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV9AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV9AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
Environmental monitoring Vessel	Sportfisher	OMV10T1	Main Engine - In Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV10M1	Main Engine - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV10AT1	Auxiliary Engines - Transit	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES
		OMV10AM1	Auxiliary Engines - Maneuvering	NO	NO	YES	YES	NO	NO	YES	YES	YES	YES

Note: Refer to OCS Air Permit Application Sections 5.2.4 and 5.5.3 for more detailed analysis and description.

Appendix B
Agency Correspondence

B-1
Notice of Intent

August 5, 2022

Ms. Suna Y. Sariscak
Manager, Air Quality Permits Program
suna.sariscak@maryland.gov
Maryland Department of the Environment
1800 Washington Blvd.
Baltimore, MD 21230

Re: Notice of Intent to Submit an Application for an Outer Continental Shelf Air Permit
Maryland Offshore Wind Project – US Wind, Inc.

Dear Ms. Sariscak:

US Wind, Inc. (US Wind) is submitting the enclosed Notice of Intent (NOI) as required by the Outer Continental Shelf (OCS) Air Regulations in Code of Federal Regulations (CFR) Title 40, Part 55, for the proposed installation and operation and maintenance of the Maryland Offshore Wind Project (Project). Decommissioning of the Project would be completed after the 25-year operational phase, therefore a separate OCS air permit application will be submitted for decommissioning at a later date prior to the conclusion of the operational period.

40 CFR § 55.4(a) specifies that within 18 months prior to submitting an application for a preconstruction permit for a source located within 25 nautical miles of a State's seaward boundaries, the applicant must submit an NOI to the U.S. Environmental Protection Agency (USEPA) regional office and to the air pollution control agencies of the Nearest Onshore Area (NOA) and areas adjacent to the NOA. As of July 21, 2015, the Maryland Department of the Environment (MDE) has been delegated the authority to implement and enforce sections of the OCS Air Regulations.

This NOI is being provided to the air pollution control agencies of the NOA and onshore areas adjacent to the NOA per 40 CFR § 55.4. The Corresponding Onshore Area (COA) for the Project is Maryland, which is the NOA, and the onshore areas adjacent to the NOA include Delaware. A copy of this NOI has also been filed with the USEPA Region 3 Office.

Please contact me at 410-340-9428 or l.jodziewicz@uswindinc.com if you have any questions regarding this submittal.

Sincerely,

Laurie Jodziewicz
Senior Director of Environmental Affairs
US Wind, Inc.

cc:

Mary Cate Opila
Branch Chief, Permits Branch
USEPA Region 3
opila.marycate@epa.gov
Mail Code: 3AD10
1650 Arch Street, Philadelphia, PA 19103

Angela Marconi
Director, Division of Air Quality
Delaware Department of Natural Resources and Environmental Control
Angela.Marconi@delaware.gov
100 W. Water Street, Suite 6A
Dover, DE 19904

NOTICE OF INTENT
Maryland Offshore Wind Project - US Wind, Inc.

Introduction

This Notice of Intent (NOI), as required by the Outer Continental Shelf (OCS) Air Regulations in 40 Code of Federal Regulations (CFR) § 55.4, is prepared for the proposed installation and operation and maintenance (O&M) of the Maryland Offshore Wind Project (the Project). US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project, an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within OCS-A 0490 (the Lease), a federal lease for offshore wind energy development on the OCS. The area within the Lease is approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10 nautical miles [nm]) off the coast of Maryland.

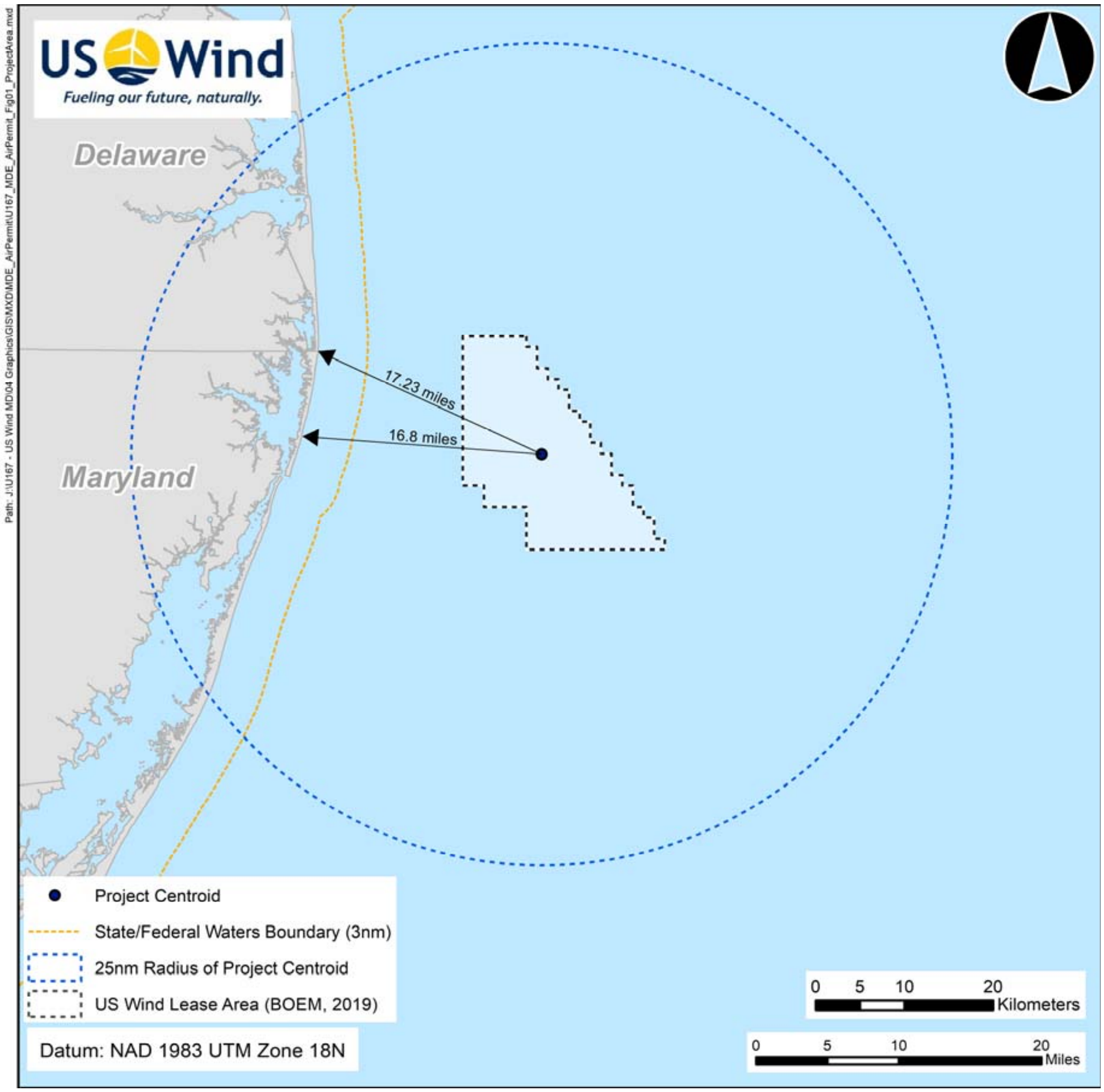
The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease area. The Project would be interconnected to the onshore electric grid by up to four (4) new export cables into new onshore substations in Delaware.

The NOI considers emissions of OCS sources associated with the Project. These emissions are defined pursuant to 40 CFR Part 55 as emissions from OCS sources, which include certain vessels while attached to the seabed or to the Project, and certain vessels traveling to and from the Project when within 25 nautical miles (nm) (46.3 kilometers [km]) of the Project's center (the 25-nm [46.3 km] centroid or the OCS centroid).

Additional details of this Project beyond that included in the NOI can be found in the Construction and Operations Plan (COP) submitted to the Bureau of Ocean Energy Management (BOEM). The Project would be installed in up to four campaigns beginning in 2024, with the first campaign commissioned and operational by the end of 2025. Decommissioning would occur after the 25-year operational phase, therefore a separate NOI would be submitted for decommissioning prior to the conclusion of the operational period.

In accordance with 40 CFR § 55.4, this NOI is being submitted to the Administrator through the United States Environmental Protection Agency (USEPA) Regional Office, with copies provided to the air pollution control agencies of the Nearest Onshore Area (NOA) and onshore areas adjacent to the NOA.
The Corresponding Onshore Area (COA) for the Project is Maryland, which is the NOA for the Project. Figure 1 depicts the distances in miles from the centroid of the Project area to several nearby onshore locations to illustrate and support the proposed designation of Maryland as the COA. The NOI includes all the required components of a NOI as listed in 40 CFR § 55.4(b)(1-10).

Figure 1. Distances to Corresponding Onshore Area



General Company Information [40 CFR § 55.4(b)(1)]

Company Name and Address:
US Wind, Inc.
401 East Pratt Street
Baltimore, MD 21202

Facility Contact:
Laurie Jodziewicz
Sr. Director of Environmental Affairs
US Wind, Inc.
401 East Pratt Street
Baltimore, MD 21202
410-340-9428
l.jodziewicz@uswindinc.com

Facility description in terms of the proposed process and products, including identification by Standard Industrial Classification Code. [40 CFR § 55.4(b)(2)]

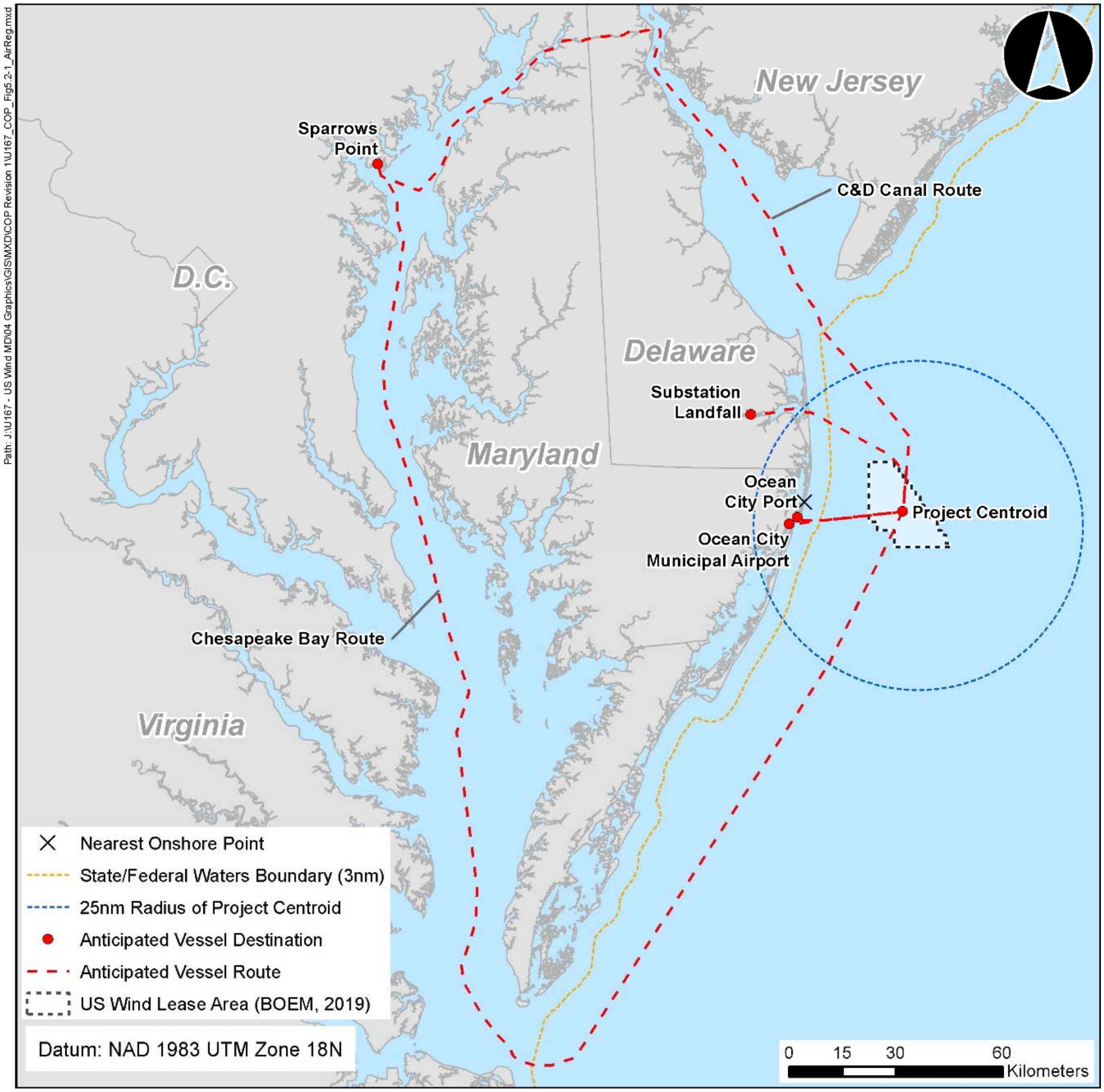
US Wind, Inc. is developing the Maryland Offshore Wind Project, an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within OCS-A 0490 (the Lease), a federal lease for offshore wind energy development on the OCS. The area within the Lease is approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10 nautical miles [nm]) off the coast of Maryland.

The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease area. The Project would be interconnected to the onshore electric grid by up to four (4) new export cables into new onshore substations in Delaware. The location of the Project is shown in Figure 2.

Standard Industrial Classification (SIC) Code:

The Standard Industrial Classification (SIC) code for the Project is 4911.

Figure 2. Project Location of Maryland Offshore Wind Project



Estimate of the proposed project's potential emissions of any air pollution, expressed in total tons per year and in such other terms as may be necessary to determine the applicability of requirements of this part. Potential emissions for the project must include all vessel emissions associated with the proposed project in accordance with the definition of potential emissions in § 55.2. [40 CFR § 55.4(b)(3)]:

As required by Section 328 of the Clean Air Act, when a vessel does not meet the definition of an OCS source, the emissions from vessels servicing or associated with any part of an OCS source are included in the potential emissions from the OCS Source when the vessel is within 25 nautical miles of the centroid of the source, including while traveling to and from any part of the OCS facility. Emissions from vessels that would support construction, operation, and maintenance of the Project when within 25 nm of the centroid are included in potential emissions of the OCS facility. These activities are summarized below and will be detailed in the OCS air permit application.

The construction of the Project is proposed for up to 4 campaigns. Each construction campaign would follow this general sequence:

- Installation of the OSS;
- Offshore export cable installation;
- WTG monopile foundation installation;
- Inter-array cable installation;
- WTG installation; and
- WTG commissioning.

The types of emissions activities included in the construction and operations and maintenance (O&M) phases are described as follows.

Construction emissions would consist of the following activities:

- Vessel transit within the OCS area (i.e., 25 nm from the centroid);
- On-vessel equipment usage including diesel generators;
- Onsite maneuvering at the WTGs and at the OSSs;
- Export and inter-array cable laying within the OCS area; and
- Commissioning activities (e.g., temporary diesel generators).

O&M emissions would consist of the following activities:

- Vessel transit within the OCS area;
- Onsite maneuvering at the WTGs and OSSs; and
- Onsite emergency generators.

Air emissions associated with the construction and O&M phases of the Project depend on many factors, such as location, scope, type, capacity of equipment, and schedule. Potential emissions would be generated by emission sources associated with the Project, such as engine exhaust from marine vessels and heavy equipment/engines used during construction. Decommissioning of the Project would be completed after the 25-year operational phase, therefore a separate OCS air permit application would be submitted for decommissioning at a later date prior to the conclusion of the O&M phase.

Air pollutants emitted during the Project's construction and O&M phases would include: nitrogen oxides (NOx); volatile organic compounds (VOC); carbon monoxide (CO); particulate matter smaller than 10 microns (PM_{10}); particulate matter smaller than 2.5 microns ($PM_{2.5}$, a subset of PM_{10}); greenhouse gas emissions as carbon dioxide equivalents (CO_2e); sulfur dioxide (SO_2); and total hazardous air pollutants (HAPs, individual compounds are either VOC or particulate matter). The potential emissions have been estimated separately for the construction phase and the O&M phase.

Construction vessels would transit between onshore support/staging facilities at potential ports located in Maryland, Virginia, or New Jersey and the Project work area. It is anticipated that the large construction vessels would be staged at Sparrows Point in Baltimore, Maryland, while support vessels for crew transfer would stage from Ocean City, Maryland during both construction and operation. Most of these vessels and onboard construction equipment would utilize diesel engines burning low sulfur fuel, while some larger construction vessels may use bunker fuel. O&M activities would likely consist of small vessels transiting to and from the Project to service the WTGs or the OSSs over the 25-year operational life. During the Project's O&M phase, crew transport vessels and service operations vessels will transport crew and equipment to the offshore Project area for inspections, routine maintenance, and repairs. Additionally, the generators located on the OSSs would complete weekly and annual testing during the Project's O&M phase.

In accordance with the Environmental Appeals Board (EAB) decision in re Shell Gulf of Mexico, Inc. and in re Shell Offshore, Inc., 15 EAD 193 (220)[1], the potential emissions of an OCS source must only include equipment in use and within 25 nautical miles of the OCS source during the time it is considered an OCS source. For instance, emissions from vessels servicing or associated with a jack-up vessel must be included in the potential emissions of the jack-up vessel only while the jack-up vessel has legs attached to the seafloor. It is difficult to predict which vessels would be enroute to and from the Project site while vessels are considered OCS sources (for example, which vessels will be enroute while a jack-up vessel is jacked up), therefore for purposes of the OCS air permit it is conservatively assumed that all vessels within 25 nautical miles of the centroid of the wind turbine array are included in the potential emissions of the construction phase of the Project, including those which are anticipated to be utilized prior to the first instance of an OCS source.

As such, the wind turbine array area is the only OCS source associated with the construction phase of the Project. The OCS source includes all vessels associated with the construction phase of the Project when those vessels are on-site (within the wind turbine array area) or enroute to or from the wind turbine array area when within 25 nautical miles[2] of the centroid of the wind turbine array area. There are no OCS sources associated with the offshore export cable installation activities as detailed below.

For a vessel to be considered an OCS source, it must be permanently or temporarily attached to the seabed and also erected on the seabed for the purposes of exploring, developing, or producing resources. Anchor-pulling vessels associated with offshore export cable installation (on waters above the OCS) are temporarily attached to the seabed, however, the vessels are not erected on the seabed because they do not remain stationary at the location of the OCS activity. Additionally, anchor-pulling vessels and their activities are not considered "exploring for, developing, or producing resources" as defined in the Outer Continental Shelf Lands Act (OCSLA). as these terms are defined in the context of platform construction and anchor-pulling vessels associated with the offshore export cable installation are not used for platform construction. The USEPA determined that, although pull-ahead anchor vessels are attached to the seabed, this equipment does not meet the other two

[1]https://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/Decision~Date/4E0547DAD63F032F852578540048BEC3/$File/Shell%20Gulf%20of%20Mexico%20II.pdf
[2] A unit of nautical miles is used in accordance with EPA interpretation of the Part 55 regulations.

criteria for classifying a vessel as an OCS source and, therefore, should not be subject to the permitting requirements applicable to OCS sources.[3]

In addition to the potential use of anchor-pulling vessels for export cable installation, US Wind may also use dynamic positioning system (DPS) vessels. A dynamic positioning system uses computer-controlled thrusters to maintain position along the cable route, and the ship's forward momentum comes from its own on-board propulsion, not winches and anchors. The USEPA has determined that cable laying vessels are not OCS sources when these vessels are using a DPS (a computer-controlled system of thrusters with no anchors) to advance and maintain lateral position along the export cable route[4]. DPS vessels may not be permanently or temporarily attached to the seabed and as such, DPS vessels are not OCS sources only on that basis. Additionally, DPS vessels are neither erected thereon nor used for the purpose of exploring, developing or producing resources therefrom. As such, USEPA has determined that cable-laying vessels using either a pull-ahead anchor system or a dynamic positioning system do not meet the criteria to qualify vessels as OCS sources. In addition, USEPA determined that emissions from these cable laying vessels will, however, be included in the potential to emit of the OCS source when located at or traveling within 25 nautical miles of the centroid of the OCS area[5].

During the Project's O&M phase, emissions would be far less than during construction. The operation of the WTGs would not generate air emissions. The only "permanent and stationary" source of potential emissions are diesel electric generators that would be installed on the OSSs. The OSSs meet the definition of an OCS source as they would be attached to the OCS and would have emissions from those diesel electric generators.

A summary of the *preliminary* potential annual OCS air emission estimates is presented in Table 1 for construction and O&M activities. Preliminary potential emissions presented in this NOI during operation include potential emissions from the OSS diesel electric generators and potential emissions from vessels used to transport crew and equipment while on-site at the OSSs and WTGs or enroute to and from the OSSs and WTGs, and for routine maintenance and infrequent repairs. The preliminary potential emissions during construction include vessel transit within the OCS for WTG and OSS installation, including on vessel equipment usage and propulsion engine usage. Construction emissions also include vessel emissions within the OCS for export and inter-array cable laying activities.

The Project would be constructed in up to four campaigns over [4] years, therefore some portions of the wind farm would be under construction while other parts would be operational. Annual construction emissions reflect these overlapping periods by including O&M emissions for WTGs that have been commissioned and are operational while the remainder of the WTGs and OSSs are constructed and commissioned.

Detailed emissions calculations are presented in Appendix A.

The *preliminary* estimate of the Project's potential air emissions was conducted assuming that all WTG positions, all OSSs, and the maximum length of inter-array, and offshore export cables would be installed based on the PDE, which represents the maximum design scenario. The emissions rates provided in Table 1 are conservative as they are based on BOEM Tool default emission factors and operational assumptions. For example, the vessels main and auxiliary engines are assumed to operate 24 hours a day within 25 nautical miles of the Project, which is not how the vessels would operate during the construction campaigns. Additionally, these emission estimates do not take into consideration a regulatory control technology assessment (i.e., a Best

[3] The June 24, 2021 Fact Sheet for South Fork Wind can be accessed at https://www.epa.gov/caa-permitting/south-fork-wind-llcs-south-fork-windfarm-outer-continental-shelf-air-permit
[4] EPA Memorandum, Source Determination Analysis for Vineyard Wind OCS Windfarm (June 26, 2019)
[5] The June 24, 2021 Fact Sheet for South Fork Wind.

Available Control Technology (BACT) assessment) that would be required to be included within the OCS Air Permit Application. The emission estimates would be updated in the OCS Air Permit Application to reflect refinements in the Project design and construction plan and to reflect more refined emission factors based on the results of the regulatory control technology assessments for vessel and auxiliary engine operations.

Description of all emissions points including associated vessels. [40 CFR § 55.4(b)(4)]:

The general process for installation of the Project involves the installation of the foundations to the sea floor and preparation of the structures for the WTGs and the OSSs. Work vessels would then transport the WTG and OSS components and install them on the foundations.

Offshore construction is anticipated to be completed in the following general sequence, which is further described in the COP submitted to BOEM:

- Installation of the OSS;
- Offshore export cable installation;
- WTG monopile foundation installation;
- Inter-array cable installation;
- WTG installation; and
- WTG commissioning.

The pollutant-emitting activities within the wind development area (WDA) are part of a single plan to construct and operate the Project. For Part 55 OCS air permits, the definition of the WDA comprises the WTGs and their foundations, the OSSs and their foundations, and the inter-array cables. In addition to the windfarm components in the WDA, the facility would include vessels when they meet the definition of an OCS source in Part 55 (i.e., when permanently or temporarily attached to the seabed for the purpose of exploring, developing, or producing resources; or physically attached to an OCS facility).

During construction, pollutant-emitting activities from the windfarm include temporary diesel generators (i.e., engines) used to supply power to the WTGs and OSSs during commissioning, temporary diesel generators associated with powering noise attenuation technologies, and engines on vessels that meet the definition of OCS source. During the O&M phase, pollutant-emitting activities from the windfarm would include engines on vessels that meet the definition of an OCS source, as well as generators on the OSSs.

As required by Section 328 of the Clean Air Act, when a vessel does not meet the definition of an OCS source, the emissions from vessels servicing or associated with any part of an OCS source are included in the potential emissions from the OCS Source when the vessel is within 25 nautical miles of the centroid of the source, including while traveling to and from any part of the OCS facility. Emissions from vessels that would support construction, operation, and maintenance of the Project when within 25 nm of the centroid are included in potential emissions of the OCS facility.

Table 1: Construction and O&M Emission Estimates

Phase	NO_x	VOC	CO	PM10	PM2.5	SO_2	CO_2	CH_4	N_2O	HAP	CO2e
Total Construction Period Emissions (tons per year) (Includes O&M and Commissioning Emissions)											
Year 1	817.7	10.9	192.2	16.3	15.8	31.9	52,661.0	0.2	0.04	1.5	52,678.7
Year 2	2,097.2	28.0	493.0	41.7	40.5	81.9	135,068.7	0.5	0.1	3.9	135,114.1
Year 3	1,171.3	15.7	275.3	23.3	22.6	45.7	75,435.7	0.3	0.1	2.2	75,461.1
Year 4	486.7	6.5	114.4	9.7	9.4	19.0	31,350.1	0.1	0.02	0.9	31,360.6
Total	4,572.9	61.1	1,074.9	91	88.3	178.5	294,515.5	1.1	0.2	8.5	294,614.5
Total O&M Emissions (tons per year)											
Annual	85.9	1.1	20.2	1.7	1.7	3.3	5,530.8	0.02	0.004	0.2	5,532.7

The types of emissions activities included in the construction and O&M are described as follows.

Construction emissions would consist of the following activities:

- Vessel transit within the OCS area (i.e., 25 nm from the centroid);
- On-vessel equipment usage including diesel generators;
- Onsite maneuvering at the WTGs and at the OSSs;
- Export and inter-array cable laying within the OCS area; and
- Commissioning activities (e.g., temporary diesel generators).

O&M emissions would consist of the following activities:

- Vessel transit within the OCS area;
- Onsite maneuvering at the WTGs and OSSs; and
- Onsite emergency generators.

Vessels

Most of the air emissions from the Project would come from the main and auxiliary engines of the various construction equipment and vessels. A summary of air emission sources for WTG installation as well as cable laying and OSS construction are shown in Table 2. The types of vessels expected to be used for the Project are listed and were classified as consistent with the equipment types used within the BOEM emission estimating tool.

Table 2: Emission Source Descriptions

Emission Source	Purpose	Phase
Heavy lift crane vessels	Lift, support, and orient the components of each WTG and OSS during installation. Used for foundation installation.	Construction
Cable installation vessels	Lay and bury transmission cables in the seafloor.	Construction
Scour protection installation vessels	Deposit a layer of stone around the WTG and OSS foundations to prevent the removal of sediment by hydrodynamic forces. May place cable protection over limited sections of the offshore cable system.	Construction
Multipurpose offshore support vessels	Clear the seabed floor of debris prior to laying transmission cables.	Construction
Tugboats	Transport equipment and barges to the OCS source.	Construction and as needed Operational
Anchor handling tug supply vessels	Install underwater noise mitigation devices (e.g., bubble curtains). Support offshore export cable installation.	Construction

Emission Source	Purpose	Phase
Jack-up vessels	Transport WTG components to the WDA. Extend legs to the ocean floor to provide a safe, stable working platform used for offshore crew accommodation.	Construction and, as needed, Operational
Dredging vessels	Used in certain areas prior to cable laying to remove the upper portions of sand waves.	Construction
Survey vessels	Used to perform geophysical and geotechnical surveys.	Construction
Service operation vessels	Transport crew to the WDA. Provide offshore living accommodation and workspace.	Construction and, as needed, Operational
Ocean-Going Heavy Transport Vessels (HTV)	Ocean-going vessels that may transport components (e.g., monopiles) directly to the WDA.	Construction
Offshore Substation Diesel Electric Generator	An OSS serves as the common interconnection point for the WTGs. The WTGs would interconnect with an OSS via a submarine cable system. Each OSS may have a diesel electric generator.	Construction and Operational

A complete description of all of the emission points associated with the Project, including engine sizes, hours of operation, load factors, emission factors, and fuel consumption rates would be provided in the OCS Air Permit Application.

Estimate of quantity and type of fuels and raw materials to be used. [40 CFR § 55.4(b)(5)]:

The quantities of fuels estimated to be used in vessels for Project construction, operation and maintenance are summarized in Table 3.

Table 3: Estimated Fuel Usages

Activity	Diesel, Marine Fuel, and Gasoline (Gal)
Construction (4-Year Total)	25,314,872
Operation and Maintenance (25-Year Total)	12,288,368

Diesel fuel, marine fuel oil, and gasoline are the fuels anticipated to be used for this Project. No other raw materials other than fuels would be used for the Project installation.

Description of proposed air pollution control equipment [40 CFR § 55.4(b)(6)]:

No air pollution control equipment is currently proposed for this Project. All engines used would meet applicable state and federal emission control requirements. The engines and generators used in this Project would be certified by the manufacturer to comply with applicable non-road or marine engine emission standards.

US Wind will conduct a Best Available Control Technology (BACT) analysis for each Project emission source type subject to federal Prevention of Significant Deterioration (PSD) air permit requirements at 40 CFR § 52.21, to determine which air pollution control technologies represent BACT for each source type as part of the MDE air permitting process. In addition, US Wind will conduct a Lowest Achievable Emission Rate (LAER) analysis for any pollutants subject to Federal and State non-attainment new source review air permit requirements.

Proposed limitations on source operations or any work practice standards affecting emissions [40 CFR § 55.4(b)(7)]:

- Vessels providing construction or maintenance services would use low sulfur fuel where possible.
- Vessels constructed on or after January 1, 2016 would meet Tier III NO_X requirements when operating within Emission Controls Areas (locations up to 200 nautical miles off of US shores) as required by Annex VI of the MARPOL Treaty, set forth by the International Maritime Organization (IMO). In the event that a vessel becomes an OCS source, any compression ignition internal combustion engine that operates on that vessel while it is an OCS source will become subject to 40 CFR Part 60, Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines). Equipment and fuel suppliers would provide equipment and fuels that comply with the applicable USEPA or equivalent emission standards.
- Unnecessary idling of Project engines would be limited to the extent practicable.

Other information affecting emissions, including, where applicable, information related to stack parameters (including height, diameter, and plume temperature), flow rates, and equipment and facility dimensions [40 CFR § 55.4(b)(8)]:

The emission points would consist of engine exhausts from vessels or emergency generators. A complete description of all of the emission points associated with the Project, including proposed exhaust heights and flow rates will be provided in the OCS Air Permit application.

Such other information as may be necessary to determine the applicability of onshore requirements [40 CFR § 55.4(b)(9)]:

Maryland is the NOA for the Project. If the NOA becomes the designated COA per 40 CFR § 55.5, the Project will be subject to the applicable requirements of the Code of Maryland Regulations (COMAR) Title 26 Subtitle 11, which have been incorporated into 40 CFR Part 55 by reference and have been listed in Appendix A of the OCS Air Regulations. If Maryland is designated as the COA, the following regulations will apply to the Project:

- COMAR 26.11.01 - General Administrative Provisions
- COMAR 26.11.02 - Permits, Approvals, and Registrations
- COMAR 26.11.03 - Permits, Approvals, and Registration - Title V
- COMAR 26.11.05 - Air Pollution Episode System
- COMAR 26.11.06 - General Emission Standards, Prohibitions, and Restrictions
- COMAR 26.11.09 - Control of Fuel-Burning Equipment, Stationary Internal Combustion Engines and Certain Fuel-Burning Installations
- COMAR 26.11.13 - Control of Gasoline and Volatile Organic Compound Storage and Handling
- COMAR 26.11.15 - Toxic Air Pollutants
- COMAR 26.11.16 - Procedures Related to Requirements for Toxic Air
- COMAR 26.11.17 - Nonattainment Provisions for Major New Sources and Major Modifications
- COMAR 26.11.19 - Volatile Organic Compounds from Specific Processes

- COMAR 26.11.20 - Mobile Sources
- COMAR 26.11.26 - Conformity
- COMAR 26.11.35 - Volatile Organic Compounds from Adhesives and Sealants
- COMAR 26.11.36 - Distributed Generation
- COMAR 26.11.39 - Architectural and Industrial Maintenance (AIM) Coatings

Such other information as may be necessary to determine the source's impacts in onshore areas [40 CFR § 55.4(b)(10)]:

Additional detailed information related to source impacts to onshore areas is included in the COP submitted to BOEM. Because the centroid of the Project is approximately 16.8 miles offshore, to the east of the mainland, and prevailing winds are from the west, the Project is unlikely to have any effect on onshore areas. Further, construction emissions would be temporary, and operational emissions would be a small fraction of existing marine vessel emissions in the area. Finally, the Project's impacts would be minimized and mitigated through the OCS Air Permit process. If the NOA becomes the designated COA per 40 CFR § 55.5, emissions from the construction-phase OCS sources would need to meet applicable Maryland BACT and LAER emission limits, and offset NOx emissions through the use of emission reduction credits.

Appendix A
Detailed Emission Calculations and Assumptions

U.S. Wind Inc. Maryland Offshore Wind Project
Construction and O&M Emission Estimates Summary

			Tons/Year										
			NO_X	VOC	CO	PM10	PM2.5	SO_2	CO_2	CH_4	N_2O	HAP	CO_2e
2024	Construction	Buildout 1	817.7	10.9	192.2	16.3	15.8	31.9	52,661.0	0.2	0.0	1.5	52,678.7
	Operations	Not Applicable	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	Total	817.7	10.9	192.2	16.3	15.8	31.9	52,661.0	0.2	0.04	1.5	52,678.7
2025	Construction	Buildout 2	2,081.3	27.8	489.3	41.4	40.2	81.3	134,046.2	0.5	0.1	3.9	134,091.2
	Operations	Buildout 1	15.9	0.2	3.7	0.3	0.3	0.6	1,022.5	0.0	0.0	0.0	1,022.9
	Total	Total	2,097.2	28.0	493.0	41.7	40.5	81.9	135,068.7	0.5	0.1	3.9	135,114.1
2026	Construction	Buildout 3	1,115.0	14.9	262.1	22.2	21.5	43.6	71,810.5	0.3	0.1	2.1	71,834.6
	Operations	Buildouts 1,2	56.3	0.8	13.2	1.1	1.1	2.2	3,625.3	0.0	0.0	0.1	3,626.5
	Total	Total	1,171.3	15.7	275.3	23.3	22.6	45.7	75,435.7	0.3	0.1	2.2	75,461.1
2027	Construction	Buildout 4	408.8	5.5	96.1	8.1	7.9	16.0	26,330.5	0.1	0.0	0.8	26,339.4
	Operations	Buildouts 1,2,3	77.9	1.0	18.3	1.6	1.5	3.0	5,019.6	0.0	0.0	0.1	5,021.3
	Total	Total	486.7	6.5	114.4	9.7	9.4	19.0	31,350.1	0.1	0.02	0.9	31,360.6
2028-2049	Operations	Buildouts 1,2,3,4	85.9	1.1	20.2	1.7	1.7	3.3	5,530.8	0.02	0.004	0.2	5,532.7
2050	Operations	Buildouts 2,3,4	70.0	0.9	16.5	1.4	1.4	2.7	4,508.3	0.0	0.0	0.1	4,509.9
2051	Operations	Buildouts 3,4	29.6	0.4	7.0	0.6	0.6	1.1	1,905.6	0.0	0.0	0.1	1,906.2
2052	Operations	Buildout 4	7.9	0.1	1.9	0.2	0.2	0.3	511.3	0.0	0.0	0.0	511.4
4-Year Construction and 25-Year Operational Period Totals			Tons										
Project Total Emissions	Construction	Project	4,422.8	59.2	1,039.7	88.0	85.4	172.8	284,848.1	1.1	0.2	8.3	284,943.9
	Operations	Project	2,146.3	28.7	504.7	42.7	41.4	82.7	138,271.2	0.5	0.1	4.0	138,317.7
	Total	Project	6,569.0	87.9	1,544.4	130.8	126.8	255.6	423,119.3	1.7	0.3	12.3	423,261.6

Buildout Year	Construction Year	Operation Years	Operational Years	WTG	OSS	Met Tower	Total	Total
1	2024	2025-2049	25	20	1	1	22	18%
2	2025	2026-2050	25	55	1	0	56	47%
3	2026	2027-2051	25	29	1	0	30	25%
4	2027	2028-2052	25	10	1	0	11	9%

U.S. Wind Inc. Maryland Offshore Wind Project
Construction and O&M Emission Calculations

Construction Emissions within OCS Air Permit Area (25 nm of Project centroid)

Vessel Type	NO_X	VOC	CO	PM10	PM2.5	SO_2	CO_2	CH_4	N_2O	HAP
Barge	1,284.9	17.2	302.0	25.6	24.8	49.9	82,754.8	0.3	0.1	2.4
Cable Laying	861.9	11.5	202.6	17.2	16.6	34.1	55,513.6	0.2	0.0	1.6
Crew	374.9	5.0	88.1	7.5	7.2	14.4	24,145.7	0.1	0.0	0.7
Jackup	462.6	6.2	108.7	9.2	8.9	18.2	29,794.3	0.1	0.0	0.9
Research/Survey	162.9	2.2	38.3	3.2	3.1	6.4	10,488.5	0.0	0.0	0.3
Supply Ship	1,086.9	14.5	255.5	21.6	21.0	42.5	69,998.6	0.3	0.1	2.0
Tug	188.7	2.5	44.4	3.8	3.6	7.3	12,152.6	0.0	0.0	0.4

Total 25-Year Operational Emissions within OCS Air Permit region (25 nm of Project centroid)

Vessel Type/Stationary Source	NO_X	VOC	CO	PM10	PM2.5	SO_2	CO_2	CH_4	N_2O	HAP
Crew	1948.7	26.06	458.09	38.79	37.6	74.9	125507.1	0.50	0.10	3.65
Research/Survey	197.4	2.64	46.41	3.93	3.8	7.8	12716.4	0.05	0.01	0.37
OSS Generator	0.1	0.01	0.25	0.0	0.0	0.0	47.7	0.00	0.00	0.00

Notes:
1. Emissions for NOx, PM2.5, and SO2 based on BOEM Tool as provided in May 2022 US Wind Construction and Operations Plan (COP) and Project specific design critera.
2. The BOEM Tool uses the latest EPA emission factors from the Ports Emissions Inventory Guidance/Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions Report (EPA 420-B-20-046, September 2020). The factors in Table A-1 for CO2, NOx, PM2.5, and SO2 are applied to all marine vessel types and engines (main propulsion engines or auxiliary engines)

Table A-1. Diesel Emission Factors
Emission Factors g/kWh

	CO_2	NOx	PM2.5	SO_2
Marine Diesel Engine	679.47	10.55	0.2036	0.4
Generator (150 kW)	679.47	1.3	0.0291	0.006246

3. Emission factors for VOC, CO, PM10, CH4, and HAPs were based on the latest EPA emission factors from the Ports Emissions Inventory Guidance/Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions Report (EPA 420-B-20-046, September 2020).

Emission Factors g/kWh

	VOC	CO	PM10	CH_4	N_2O	HAP
Marine Diesel Engine	0.1411	2.48	0.210	0.0027	5.40E-04	0.020
Generator (150kW)	0.19	3.5	0.03	0.0027	5.40E-04	0.021

Pollutant	Code	Basis	Fraction
1,3-Butadiene	106990	VOC	0.001013
2,2,4-Trimethylpentane	540841	VOC	0.00712
Acenaphthene	83329	VOC	0.0000509
Acenaphthylene	208968	VOC	0.000118
Acetaldehyde	75070	VOC	0.009783
Acrolein	107028	VOC	0.001848
Ammonia	NH3	PM2.5	0.019247
Anthracene	120127	VOC	0.000344
Antimony	7440360	PM2.5	0.000615
Arsenic	7440382	PM2.5	0.0000259
Benz[a]Anthracene	56553	PM2.5	8.82E-06
Benzene	71432	VOC	0.004739
Benzo[a]Pyrene	50328	PM2.5	4.18E-06
Benzo[b]Fluoranthene	205992	PM2.5	8.35E-06
Benzo[k]Fluoranthene	207089	PM2.5	4.18E-06
Benzo(g,h,i)Fluoranthene	203123	PM2.5	0.000132
Cadmium	7440439	PM2.5	0.000236
Chrysene	218019	PM2.5	0.0000163
Chromium VI	18540299	PM2.5	7.24E-09
Dibenzo[a,h]anthracene	53703	PM2.5	8.65E-06
Ethyl Benzene	100414	VOC	0.000439
Fluoranthene	206440	PM2.5	0.0000897
Fluorene	86737	VOC	0.000164
Formaldehyde	50000	VOC	0.042696
Indeno[1,2,3-c,d]Pyrene	193395	PM2.5	8.35E-06
Lead	7439921	PM2.5	0.000125

Manganese	7439965	PM2.5	3.22E-06
Mercury	7439976	PM2.5	4.18E-08
Naphthalene	91203	VOC	0.031304
Hexane	110543	VOC	0.00279
Nickel	7440020	PM2.5	0.000687
Polychlorinated Biphenyls	1336363	PM2.5	4.18E-07
Phenanthrene	85018	VOC	0.001356
Propionaldehyde	123386	VOC	0.001517
Pyrene	129000	PM2.5	0.0000337
Selenium	7782492	PM2.5	4.38E-08
Toluene	108883	VOC	0.002035
Xylenes (Mixed Isomers)	1330207	VOC	0.001422
o-Xylene	95476	VOC	0.000513
	NA	VOC	0.1092519
HAP Total	NA	PM2.5	0.0212539

4. Emission factors for N_2O were based on the latest 40 CFR Part 98 reporting factors.

B-2
USEPA Alternative Model Request and Approval

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

September 11, 2023

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Model Clearinghouse review of an alternative model application of AERCOARE in conjunction with AERMOD in support of Outer Continental Shelf PSD air permitting of the US Wind Maryland Offshore Wind Project

FROM: George Bridgers, Model Clearinghouse Director
Air Quality Modeling Group, Air Quality Assessment Division
Office of Air Quality Planning and Standards

TO: Timothy A. Leon Guerrero, Meteorologist
Air Quality Analysis Branch, Air & Radiation Division
EPA Region 3, Philadelphia, PA

THROUGH: Alice Chow, Branch Chief
Air Quality Analysis Branch, Air & Radiation Division
EPA Region 3, Philadelphia, PA

INTRODUCTION

US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project, an offshore wind energy project in a federal lease area on the Outer Continental Shelf (OCS) approximately 18.5 km (10 nautical miles) off the coast of Maryland. The Maryland Offshore Wind Project will include up to 121 wind turbine generators, 4 offshore substations, and 1 meteorological tower and have an approximate production capacity of 2 gigawatts (GW). The project will be interconnected to the onshore electric grid by up to 4 export cables into onshore substations in Delaware.

The Maryland Offshore Wind Project is subject to Prevention of Significant Deterioration (PSD) permitting and is required to submit an OCS Air Permit application that includes a dispersion modeling demonstration that air emissions from the Project will not cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS) or PSD increments. US Wind expects that emissions of one or more criteria air pollutants would exceed the pollutant specific PSD significant emission rates (SER) and, consequently, an air quality assessment, including air quality modeling, to determine the potential impact of the project emissions on the NAAQS and all applicable PSD increment levels will be required.

US Wind has requested to use an alternative model, as provided in Section 3.2 of the *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W), to conduct its PSD air quality modeling analysis of the Maryland Offshore Wind Project's construction and operation and maintenance (O&M) activities. This alternative model request has been routed through the Maryland Department of the Environment (MDE), which, as a permit reviewing authority, subsequently submitted the request to the U.S. Environmental Protection Agency (EPA) Region 3.[1] Specifically, US Wind has requested to use the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm, as implemented in the AERCOARE meteorological data preprocessor program, to prepare meteorological data for use in the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) dispersion program in lieu of the preferred Offshore and Coastal Dispersion (OCD) model to assess ambient impacts in a marine environment.[2]

REGIONAL OFFICE REVIEW

EPA Region 3 seeks concurrence from the EPA's Model Clearinghouse (Model Clearinghouse or MCH) regarding the prospective EPA Region 3 approval of an alternative model for the compliance demonstration requirements of US Wind's Maryland Offshore Wind Project. As noted above, the AERCOARE meteorological data preprocessor program will be used in conjunction with AERMOD (AERCOARE-AERMOD) to conduct the air quality modeling analysis as part of this OCS air permit application. US Wind is seeking approval to allow the use of the coupled AERCOARE-AERMOD alternative model methodology or approach for their required air quality modeling analysis, under the *Guideline*, Section 3.2.2(b), Condition (3).

EPA Region 3 has conducted a thorough review of US Wind's request and has found the proposed application of the alternative model to be satisfactory and addresses the requirements of the *Guideline*, Section 3.2.2(b), Condition (3), including the subsequent five elements contained in Section 3.2.2(e). As such, pursuant to the *Guideline*, Sections 3.0(b) and 3.2.2(a), Region 3 currently intends to approve the use of proposed coupled AERCOARE-AERMOD alternative model approach for the Maryland Offshore Wind Project air permit application.

MODEL CLEARINGHOUSE REVIEW

The specifics of the EPA Region 3 review and the basis for their intention to approve the proposed AERCOARE-AERMOD alternative modeling approach for the Maryland Offshore Wind Project are presented in detail in the EPA Region 3 alternative model concurrence request memorandum and MDE alternative model request package submitted to the Model Clearinghouse on August 17, 2023.[3] Given the similarities in scope and almost identical points

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[1] https://gaftp.epa.gov/Air/aqmg/SCRAM/mchisrs/23-III-01_USWindMDRequestApprovalLetter-MDEFinalSigned_Stamped.pdf.

[2] The OCD dispersion model is listed in Section 4.2.2.3 of the *Guideline* as the Environmental Protection Agency's preferred model for over-water modeling.

[3] https://gaftp.epa.gov/Air/aqmg/SCRAM/mchisrs/23-III-01_Region3_MCHRequest_USWind.pdf and https://gaftp.epa.gov/Air/aqmg/SCRAM/mchisrs/23-III-01_USWindMDRequestApprovalLetter-MDEFinalSigned_Stamped.pdf.

of justification made by US Wind to several other Model Clearinghouse actions over the past several years regarding the use of the coupled AERCOARE-AERMOD alternative model approach, we will not reiterate each aspect of the Regional Office review in this concurrence response memorandum.[4] The Model Clearinghouse affirms the Region 3 conclusion that circumstances surrounding and the alternative model request package submitted for the Maryland Offshore Wind Project follows a nearly identical pathway to these previously EPA approved alternative models.

The Model Clearinghouse continues to agree with the technical merits of this common themed alternative model justification for the coupled AERCOARE-AERMOD approach, as long as there is an appropriate level of consultation with the Regional Office on the manner in which the alternative model will be applied in the air quality modeling analysis for the project's PSD air permit application, including an assessment of potential concerns with platform downwash and shoreline fumigation. The Model Clearinghouse encourages reviewers of this alternative model concurrence to reference the EPA Region 3 alternative model concurrence request memorandum and MDE alternative model request package for specific details of EPA Region 3's review of US Wind's alternative model request and justification.

CONCURRENCE SUMMARY

The Model Clearinghouse concurs with EPA Region 3's proposed approval of a coupled AERCOARE-AERMOD alternative modeling approach for the air quality modeling analysis required in the Maryland Offshore Wind Project based on the alternative model request package provided by US Wind and MDE and the review documentation in the alternative model concurrence request memorandum provided by EPA Region 3. The Model Clearinghouse encourages EPA Region 3 to respond to US Wind, MDE, and to the docket for federal permitting actions related to the Maryland Offshore Wind Project with a letter of alternative model approval, as appropriate. The information associated with the EPA Region 3 alternative model approval and the Model Clearinghouse concurrence should be available for comment during the appropriate public comment period(s).

Given the possible importance of platform downwash and shoreline fumigation, the Model Clearinghouse continues to recommend caution and careful review before additional alternative model considerations of the coupled AERCOARE-AERMOD model methodology in other projects. This case-specific Model Clearinghouse concurrence does not constitute a generic approval of a coupled AERCOARE-AERMOD approach for other applications elsewhere. However, the scope of the technical assessment submitted here and with similar AERCOARE-AERMOD alternative model requests continue to provide a good basis for such considerations.

For any future projects considering the use of a coupled AERCOARE-AERMOD approach, including differing phases of a project to which those phases were not considered as part of a previous EPA alternative model approval, EPA Regional Office approval with Model Clearinghouse concurrence is required per the *Guideline*, Section 3.2. Early consultation with the

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[4] Please reference the EPA Model Clearinghouse Information Storage and Retrieval System (MCHISRS) database for more information regarding recent AERCOARE-AERMOD alternative model reviews and approvals (http://cfpub.epa.gov/oarweb/MCHISRS/, text Search term "AERCOARE").

appropriate reviewing authority and EPA Regional Office is always strongly recommended for any alternative model application other than the preferred OCD model approach for overwater or OCS sources.

cc: Richard Wayland, C304-02
Scott Mathias, C504-01
Tyler Fox, C439-01
Rochelle Boyd, C504-03
EPA Air Program Managers
EPA Regional Modeling Contacts

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
FOUR PENN CENTER – 1600 JOHN F. KENNEDY BLVD.
PHILADELPHIA, PENNSYLVANIA 19103

MEMORANDUM

SUBJECT: Model Clearinghouse review of an alternative model application of AERCOARE in conjunction with AERMOD in Support of Outer Continental Shelf PSD air permitting of the US Wind Maryland Offshore Wind Project

FROM: Timothy A. Leon Guerrero, Meteorologist
Air Quality Analysis Branch, Air & Radiation Division
EPA Region 3, Philadelphia, PA

THROUGH: Alice Chow, Branch Chief
Air Quality Analysis Branch, Air & Radiation Division
EPA Region 3, Philadelphia, PA

TO: George Bridgers, Director of Model Clearinghouse
Air Quality Modeling Group, Air Quality Assessment Division,
Office of Air Quality Planning and Standards

The U.S. Environmental Protection Agency (EPA) Region 3 office seeks concurrence from the Model Clearinghouse regarding its approval of a request for the use of an alternative model for an Outer Continental Shelf (OCS) Prevention of Significant Deterioration (PSD) permit. Region 3 seeks Model Clearinghouse concurrence to use the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm, as implemented in the meteorological data processor program (AERCOARE), to prepare meteorological data for use with the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). AERCOARE, a meteorological data preprocessor program, will be used in conjunction with AERMOD (AERCOARE/AERMOD) to conduct an air quality impact analysis as part of the OCS air permit application for US Wind's Maryland Offshore Wind Project located off the coast of Maryland; Worcester County, Maryland is the nearest onshore area for the Project.

On 11 July 2023, EPA Region 3 received a letter from Serena McIlwain, Secretary, Maryland Department of the Environment (MDE), formally submitting a request to use AERCOARE/AERMOD as an alternative model for assessing air quality standards compliance for US Wind's Maryland Offshore Wind Project emission sources located over water. AERCOARE/AERMOD was proposed in lieu of the Offshore and Coastal Dispersion (OCD) model, which is the current Guideline on Air Quality Models (40 CFR 51 Appendix W) preferred model for over-water dispersion.

Section 3.2.1(b) of Appendix W outlines the general process of how alternative models are approved. In accordance with this section, Regional Administrators have delegated authority to issue such approvals under section 3.2. Such approvals are issued after consultation with the EPA's Model Clearinghouse and formally documented in a concurrence memorandum from the EPA's Model Clearinghouse which demonstrates that the requirements within section 3.2 for use of an alternative model have been met.

EPA Region 3 based its approval of US Wind's request to use the AERCOARE/AERMOD model for its air quality impact analysis, under 40 CFR Part 51, Appendix W §3.2.2(b)(3). Under 3.2.2(b)(3), an alternative model may be used if the Regional Office finds the conditions specified in Appendix W §3.2.2(e) are satisfied. MDE's 11 July 2023 letter outlining its alternative model request presents specific responses to the 5 points (*i-v*) outlined in section 3.2.2(e).

EPA Region 3 thoroughly reviewed MDE's submittal on behalf of US Wind and agrees that an alternative model (AERCOARE/AERMOD) is justified for this application. A summary of these points will be presented in the following sections of this memo. MDE's alternative model request submittal is also included as an enclosure. We seek the Model Clearinghouse's concurrence as part of the modeling demonstration for the US Wind's Maryland Offshore Wind Project's permit application process.

Background and Project Overview

US Wind's Maryland Offshore Wind Project will be located in the Commercial Lease of Submerged Lands for Renewable Energy Development on the OCS offshore Maryland (Lease No. OCS-A-0490). This lease area was awarded through the Bureau of Ocean Energy Management competitive renewable energy lease auction in December 2014. The Lease Area covers approximately 350 square kilometers. The nearest shoreward boundary is approximately 18.5 km off the Maryland coastline, while the farthest oceanward boundary is located approximately 43 km from the nearest point of land. A figure showing the lease area and nearest land features is included in MDE's original request (see enclosure).

When completed, US Wind's Maryland Offshore Wind Project is expected to provide approximately 2,000 megawatts (MW) of clean, reliable offshore wind energy. US Wind's preferred buildout design scenario for the Maryland Offshore Wind Project includes:

- Up to 121 wind turbine generators (WTGs) and associated WTG foundations
- Up to 4 Offshore Substations (OSSs) and associated offshore substation foundations
- Up to four (4) new export cables into new onshore substations in Delaware

Although the wind turbines themselves do not emit air pollutants and are, therefore, not "OCS sources" as defined in 40 CFR 55, jack-up vessels are expected to be used to construct the wind turbines. Air emissions from US Wind's Maryland Offshore Wind Project will primarily consist of products of combustion from the vessels associated with the construction and operation phases of this project.

Technical Basis for Alternative Model Request

MDE is requesting to use AERCOARE as an alternative to replace the regulatory AERMET preprocessor program that is specifically designed for applications over land. AERCOARE will read and process overwater meteorological data using the COARE methodology that was specifically designed for marine applications. The output from AERCOARE can then be used for input to AERMOD for modeling applications in a marine environment, such as the Maryland Offshore Wind Project's primary OCS sources. The Offshore and Coastal Dispersion or OCD dispersion model is currently listed as EPA's preferred model for over-water modeling and is briefly described in Section 4.2.2.3 of 40 CFR Part 51 Appendix W.

The following technical advantages, options, and features available in the model, AERCOARE-AERMOD, were put forth by US Wind in the 10 March 2023 letter to MDE's Suna Y. Sariscak, Manager, Air Quality Permits Program (see attachment). MDE prefers AERCOARE/AERMOD over OCD based on the technical reasons in this letter and include the following points:

1. The Plume Rise Model Enhancements (PRIME) downwash algorithm can be used to assess impacts in the cavity and wake regions of structures. While the AERMOD model does not incorporate platform downwash, US Wind has proposed use of PRIME considering the platform as a solid structure which will result in conservative, overprediction of concentrations.
2. The use of EPA Tier 2 and 3 NOx modeling options are not available in OCD but could be utilized with an AERCOARE-AERMOD approach. Specifically, the Ambient Ratio Method (ARM2), Plume Volume Molar Ratio Method (PVMRM) and Ozone Limiting Method (OLM) could be used by the Project to estimate the conversion of NOx to NO_2.
3. Output can be generated in the statistical form that is needed to assess compliance with the newer percentile-based NAAQS, such as 1-hour NO_2, SO_2 and 24-hour PM-2.5.
4. AERMOD-AERCOARE has the capability of handling a wider array of source configurations and does not limit the number of modeled sources compared to OCD, including multiple line sources, and more than 5 areas sources within the same model run.
5. The AERMOD-AERCOARE model can model volume sources, whereas OCD cannot.
6. Calm wind conditions can be processed by the AERMOD-AERCOARE model, whereas OCD cannot.
7. The dispersion algorithms used in the AERMOD portion of AERCOARE-AERMOD are considered state-of-art by EPA. OCD dispersion algorithms have not been updated to account for current advancements in boundary layer physics.
8. AERCOARE-AERMOD does not have a limit on the number of receptors that can be considered in an analysis, whereas OCD does limit the total number of receptors.
9. AERCOARE has the capability to utilize prognostic data from the Weather Research and Forecasting (WRF) model and output from the Mesoscale Model Interface (MMIF) program.
10. AERMOD incorporates options for the inclusion of varying ambient background concentrations by season and hour of day during the model run. In contrast, OCD does not have an option to incorporate ambient background concentrations within the model. Ambient background concentrations could be applied to the OCD predicted concentrations in a postprocessing step. A custom postprocessor for OCD would need to be developed.
11. Unlike OCD, AERMOD does not include algorithms to evaluate shoreline fumigation conditions. However, shoreline fumigation is not expected to be an important impact consideration for the Project emission sources. Shoreline fumigation can occur when plumes traveling in relatively stable air near the shoreline encounter the thermal internal boundary layer (TIBL) and fumigate downward, potentially resulting in elevated pollutant concentrations at the ground. The TIBL is the boundary layer that can form between the more stable over-water air mass and the less stable over-land air mass and typically forms during sea breeze conditions. EPA modeling guidance indicates that shoreline fumigation can be an important phenomenon on and near the shoreline of bodies of water for sources with tall stacks located on or just inland of a shoreline. However, the Project emissions (primarily vessels) are emitted from stacks with low release heights that will generally be located far offshore (the Project site is located 18.5 km offshore). Exhaust plumes are expected to be substantially dispersed before encountering the TIBL and potential fumigation conditions. Therefore, shoreline fumigation is not expected to be

an important impact condition for Project emissions and is not proposed to be specifically evaluated for the air quality analysis.

Unlike OCD, AERMOD does not include algorithms to evaluate shoreline fumigation conditions. As noted in US Wind's documentation, they do not expect shoreline fumigation to be an important impact consideration for their primary emission sources. Shoreline fumigation can occur when plumes traveling in relatively stable air near the shoreline encounter the thermal internal boundary layer (TIBL) and fumigate downward, potentially resulting in elevated pollutant concentrations at the ground. The TIBL is the boundary layer that can form between the more stable over-water air mass and the less stable over-land air mass and typically forms during sea breeze conditions.

EPA modeling guidance indicates that shoreline fumigation can be an important phenomenon on and near the shoreline of bodies of water for sources with tall stacks located on or just inland of a shoreline. US Wind's (primarily vessels) emissions are emitted from stacks with low release heights and are located well offshore (the lease area is between 18.5 and 43 km from land). Under these circumstances, exhaust plumes may be substantially dispersed before encountering the TIBL and potential fumigation conditions. MDE and US Wind may need to consider evaluating the possibility of shoreline fumigation in their final air quality impact analysis.

Modeling Approach

A modeling protocol was submitted to MDE and shared with EPA Region 3 by US Wind. This modeling protocol was developed by TRC Environmental Corporation and dated September 2022 and outlined general modeling procedures to be followed for US Wind's Maryland Offshore Wind Project. An air quality impact analysis is required under 40 CFR Part 52.21 and 40 CFR Part 55.

US Wind surveyed the closest offshore buoy collected data to its Maryland Offshore Wind Project. There are only 2 active buoys collecting meteorological data in the area; the Ocean City Inlet Buoy and the Delaware Bay 26 NM Buoy (ID #44009), which is 19 miles offshore of Ocean City MD. To run AERCOARE, the overwater meteorological file must contain the necessary hourly observations to estimate surface fluxes using the COARE algorithm, plus additional variables that are directly passed through to AERMOD. Buoy data can be used with AERCOARE, provided that it meets US EPA completeness requirements described under section 8.4.3 of Appendix W (at least 90% annual and at least 90% per calendar quarter, on average, across the 5 years processed).

A recent 5-year period (2017-2021) of meteorological data collected at the Ocean City Inlet Buoy and the Delaware Bay 26 NM Buoy, offshore of Ocean City was conducted by the applicant. Neither buoy collect the relative humidity data that are necessary inputs to AERCOARE. Additionally, annual capture statistics were calculated and it was determined that the primary meteorological variables had capture statistics ranging from 88.6 to 92.7% for the Ocean City Inlet Buoy and from 38% to 64% for the Delaware Bay Buoy. Meteorological data from these buoys, therefore, does not meet minimum criteria for completeness requirements on an annual basis.

US Wind, therefore, proposed to use 12-km WRF data and MMIF for 2019-2021 for its Maryland Offshore Wind Project. As such, US Wind requested and received prognostic (i.e., WRF data) data from US EPA Office of Air Quality Planning and Standards (OAQPS). US EPA processed the WRF data using the MMIF (Version 4.0) to convert the WRF prognostic meteorological data (2019-2021) into a format suitable for dispersion modeling applications.

Section 8.4.5 of EPA's Appendix W provides the framework for utilizing prognostic meteorological data for dispersion model applications. US Wind followed recommendations outline in this section of Appendix W including a prognostic model evaluation, assessment of representativeness and grid-cell resolution. These are presented in more detail in US Wind's 10 March 2023 letter to MDE's Suna Y. Sariscak, Manager, Air Quality Permits Program. US Wind noted that a similar alternative model request for the use of AERCOARE/AERMOD using WRF-MMIF data had been made and approved for the Park City Wind OCS wind farm project[1].

Alternative Model Proposal Review

Regulatory Analysis and Background

The PSD regulations, 40 CFR Part 52.21(l), state that all applications of air quality modeling shall be based on the preferred models specified in Appendix W. Section 40 CFR Part 52.21(l)(2) also provides on a case-by-case basis that an alternative air quality dispersion model may be used if written approval from the EPA Regional Administrator is obtained. The alternative model approval process and conditions are outlined in Section 3.2 of the Appendix W. Section 3.2.2(a) specifies that the determination of acceptability of an alternative model is an EPA Regional Office responsibility in consultation with EPA's Model Clearinghouse (MCH). An alternative model may be used subject to Regional Office approval if found to satisfy the requirements listed in Section 3.2.2. Section 3.2.2(e) sets forth the 5 elements that must be satisfied for alternative model approval:

i. The model or technique has received a scientific peer review;
ii. The model or technique can be demonstrated to be applicable to the problem on a theoretical basis;
iii. The databases which are necessary to perform the analysis are available and adequate;
iv. Appropriate performance evaluations of the model or technique have shown that the model or technique is not inappropriately biased for regulatory application a; and
v. A protocol on methods and procedures to be followed has been established.

EPA will provide a more detailed analysis of these 5 elements from Appendix W section 3.2.2(e) in the next section of this alternative model concurrence request.

Evaluation of Approach Under Appendix W Section 3.2.2(e)

Justification for the use of AERCOARE/AERMOD in Dominion's air modeling analysis are discussed in more detail below for each of the 5 elements in Appendix W section 3.2.2(e). EPA Region 3 has reviewed US Wind's support under these 5 elements and determined that the alternative model request is supported through these points.

i. The model or technique has received a scientific peer review

[1] See Model Clearinghouse Information Storage and Retrieval System Record No: 22-I-01

As described in the 2011 EPA Region 10 approval (and referenced in the 2019 EPA Region 6 approval and 2022 EPA Region 1 and 2 approvals[2]), the science behind the COARE algorithm, which is incorporated into AERCOARE, has been published in scientific peer review journals. In its approval, Region 10 confirmed the scientific legitimacy and applicability of the COARE algorithm to various over-water conditions through a sufficient body of peer-reviewed literature. The Region 10 approval also documented that the algorithms in COARE are configured to handle a wide range of temperature gradient conditions including the extremes that could be found in the Arctic or the tropics.

A key peer reviewed article that demonstrated the effectiveness of the COARE 3.0 algorithm when compared to datasets from multiple air-sea flux and bulk meteorological data collection campaigns was presented by Fairall *et al.* in 2003.

Wong *et al*. also described the concepts and configuration of the AERCOARE model and its association with AERMOD in the 2016 peer-reviewed article by Region 10 and partner scientists.

These points demonstrate that AECOARE has undergone scientific peer review.

ii. The model or technique can be demonstrated to be applicable to the problem on a theoretical basis.

EPA has previously found the AERCOARE/AERMOD approach to be applicable, on a theoretical basis, for the simulation of pollutant dispersion in the marine atmospheric boundary layer for other OCS projects. In the April 2011 Region 10 alternative model approval, EPA deemed AERCOARE/AERMOD to be appropriate for use in the Arctic marine ice-free environment. In the 2019 Region 6 AERCOARE/AERMOD alternative model approval, EPA determined the model was also appropriate on a theoretical basis for use in the subtropical marine environment off the coast of Louisiana. In the 2022 AERCOARE/AERMOD approval for the Park City Wind project, EPA Region 1 deemed it was appropriate on a theoretical basis for use in the marine environment off the coast of Massachusetts. In addition, as shown below, EPA's current user manual for AERCOARE (U.S. EPA, 2012) indicates that AERCOARE is expected to be appropriate for marine conditions at all latitudes:

> "AERCOARE uses Version 3.0 of the COARE algorithm that has been updated several times since the initial international TOGA-COARE field program in the western Pacific Ocean from November 1992 to February 1993. The basic algorithm uses air-sea temperature difference, overwater humidity, and wind speed measurements to estimate the sensible heat, latent heat, and momentum fluxes. The original algorithm was based on measurements in the tropics with winds generally less than 10 m/s but has since been modified and extensively evaluated against measurements in high latitudes with winds up to 20 m/s. Based on these studies, AERCOARE is expected to be appropriate for marine conditions found at all latitudes including the Arctic."

As described in the AERCOARE user's manual, AERCOARE calculates the meteorological input parameters needed for AERMOD by accounting for heat flux to and from the atmosphere due to the difference in temperature between the water surface and the air. AERMOD alone does not depend on parameterizations specific to overland conditions. The meteorological inputs provided by AERCOARE (for input into AERMOD) provide the information necessary to parameterize the structure of the marine atmospheric boundary layer using Monin-Obukhov Similarity Theory. This parameterization scheme is universally applicable to over-land and over-water domains. The COARE 3.0 algorithms use standard

[2] See EPA's Model Clearinghouse Information Storage and Retrieval System at: https://cfpub.epa.gov/oarweb/mchisrs/ Individual concurrence memos referenced here can be accessed by selecting the year and EPA region.

meteorological variables such as wind speed, air temperature, relative humidity, and water temperature to determine bulk transfer coefficients used in Monin-Obukhov Similarity Theory to describe the structure of the atmospheric surface layer.

Based on the information summarized above, we believe that the coupled AERCOARE/AERMOD modeling approach is applicable to US Wind's Maryland Offshore Wind Project on a theoretical basis.

iii. The databases which are necessary to perform the analysis are available and adequate.

Appendix W refers to the databases collected to develop and verify the proposed modeling methodologies. The meteorological databases that were used to develop the COARE algorithms for marine conditions are publicly available in the scientific literature. Datasets from previous dispersion experiment studies have been used to verify the accuracy of the AERCOARE/AERMOD modeling approach. There are 4 comprehensive historical overwater dispersion datasets available in the record that involve study of air pollutant dispersion in the marine atmospheric boundary layer. The following 4 tracer gas studies from the 1980s have been used in performance evaluations of OCD, CALPUFF, and AERCOARE/AERMOD:

- Cameron, Louisiana: July 1981 and February 1982 (Dabberdt, Brodzinsky, Cantrell, & Ruff, 1982)
- Carpinteria, California: September 1985 (Johnson & Spangler, 1986)
- Pismo Beach, California: December 1981 and June 1982 (Schacher, et al., 1982)
- Ventura, California: September 1980 and January 1981 (Schacher, et al., 1982)

The Region 10 alternative model approval of AERCOARE/AERMOD utilized tracer gas experiments from the 4 studies listed above. In all of the previous alternative model approvals, EPA determined that these datasets were adequate for verification of the AERCOARE/AERMOD system.

US Wind took a similar approach and provided statistics for key meteorological parameters for the Ocean City Inlet Buoy station and Delaware Bay 26 NM Buoy station (#44009) located in the Maryland Wind Farm Project area. The Delaware Bay 26 NM buoy is located 14 kilometers northeast of the project's centroid and is the nearest offshore meteorological station. The Ocean City Inlet buoy is located 29 km west of the project's centroid. Multiple WRF-MMIF extraction points were also included in US Wind's comparison to the 4 tracer studies.

Table 2 in US Wind's alternative model request summarizes key meteorological data and compares them to data from 4 tracer studies. WRF-MMIFF extraction points were also included in this comparison. Additionally, Figures 2 and 3 from US Wind's alternative model request present whisker plots visually showing the ranges of variables for the 4 trace studies versus observation points and WRF-MMIF extraction points. The comparisons of data demonstrates that the range of atmospheric conditions that typically occur in the Ocean City, Maryland offshore region fit the range of conditions used to develop and verify the COARE 3.0 algorithm.

Based on US Wind's analysis included in MDE's alternative model request, EPA believes the databases which are necessary to perform the analysis are available and adequate for determining the effectiveness of the proposed modeling approach. Thus, we feel this requirement has been fulfilled.

iv. Appropriate performance evaluations of the model or technique have shown that the model or technique is not inappropriately biased for regulatory application.

Model evaluation results for AERCOARE were presented in detail in 2 documents: (1) April 1, 2011, memorandum from EPA Region 10 and (2) EPA/ENVIRON October 2012 Model Evaluation Study. The results of both model performance evaluations indicated the model is not biased toward underestimates as discussed below.

As documented in the October 2012 Model Evaluation Study, AERCOARE Version 1.0 (12275) was applied to prepare the overwater meteorological data for the Cameron, Louisiana, and the Pismo Beach, California offshore datasets. AERCOARE simulations were conducted using 5 different methods for the preparation of the meteorological data, including the estimation of mixing heights, the use of horizontal wind direction (sigma theta data), and limitations on other variables provided to AERMOD to calculate concentrations from the field studies.

For both evaluation studies, AERMOD was run using AERCOARE along with default options for rural flat terrain for both simulations. Quantile-quantile (Q-Q) plots were prepared based on a comparison of independently ranked modeled versus observed concentrations. These Q-Q plots were included as part of MDE's alternative model request. The AERCOARE-AERMOD modeled concentrations are biased toward over-prediction for the highest concentrations, with less than a factor of 2 underprediction bias at the lower concentrations. Importantly, AERCOARE-AERMOD does not appear to be biased toward underestimates for the higher end of the frequency distribution, regardless of the 5 different meteorological preparation options examined in this study.

In EPA Region 1's review of Park City Wind, examination of whether the use of prognostic meteorological data (also used in Maryland Offshore Wind Project) generated by WRF could result in systematic underprediction of concentrations lead to the following conclusions:

> *"Additionally, Region 1 reviewed U.S. EPA (2015) to see if the WRF-MMIF inputs for AERCOARE resulted in underprediction. U.S. EPA (2015) used the four overwater dispersion study datasets listed above to compare AERCOARE/AERMOD predicted concentrations against the measured concentrations from the campaigns. This study also compared results across a set of combinations of WRF-MMIF inputs and settings. The results of this study show AERCOARE/AERMOD driven by WRF-MMIF inputs resulted in the high-end of the distribution of concentrations exceeding the measured concentrations in the Pismo and Ventura studies. Concentrations agreed well for the Carpinteria study at the high-end of the distribution in most cases. In the Cameron study, and under some of the scenarios in the Carpinteria study, the modeling resulted in underpredictions at the high-end of the distribution in some scenarios. Namely, when mixing heights were diagnosed by MMIF, instead of using the mixing heights directly from WRF, AERCOARE/AERMOD concentrations were underpredicted in some cases. The model runs using WRF-simulated mixing heights performed better, when compared to measured concentrations. Overall, however, the U.S. EPA (2015) study noted concentration bias could be attributed mainly due to error in sea-surface temperatures output from the WRF model.*
>
> *A key element to both the original Region 10 approval study and the U.S. EPA (2015) study was an evaluation of the sensitivity of the modeling results to a minimum mixing height. The Region 10 approval found AERCOARE/AERMOD results were highly overpredicted when using AERMOD's default minimum mixing height of 1 meter. EPA Region 10's sensitivity study, summarized in ENVIRON (2012) found a minimum mixing height of 25 meters for overwater*

applications was more physically realistic and resulted in better model performance. The EPA Region 10 approval allowed for the use of a minimum mixing height of 25 meters for the application of AERCOARE/AERMOD and a minimum limit on the absolute value of Monin-Obukhov Length of 5 meters. These limits are recommended in the EPA's AERCOARE User's Guide[3].

Based on the findings from the studies reviewed in the prior EPA approvals and the additional WRF-MMIF-based study, Region 1 concludes it is evident the AERCOARE/AERMOD approach does not result in systematic underprediction of concentrations. Instead, the evidence more likely leads to the conclusion the approach is conservative."

In accordance with EPA Region 1's analysis noted above, US Wind proposes to use 12-km WRF data and MMIF for 2019-2021. The proposed AERCOARE settings will include the recommendations of 25 meters for the minimum mixing height and a minimum Monin-Obukhov length of 5 meters.

Based on the study information described above, we believe it is evident the AERCOARE/AERMOD approach is not likely to result in underprediction of concentrations, but rather more likely the approach is conservative.

v. A protocol on methods and procedures to be followed has been established.

US Wind originally submitted a modeling protocol describing modeling methodologies and procedures consistent with the Guideline on Air Quality Models (Appendix W of 40 CFR 51) on September 16, 2022. US Wind amended its original approach from using EPA's OCD model to using AERCOARE/AERMOD in its alternative model request.

US Wind requested prognostic (i.e., WRF data) data from EPA Office of Air Quality Planning and Standards (OAQPS) which was received on February 9, 2023. EPA processed the WRF data using MMIF (Version 4.0) to convert the WRF prognostic meteorological data (2019-2021) into a format suitable for dispersion modeling applications. Default settings for AERCOARE processing (i.e., settings specific to AERMET are not applicable) as provided in the User's Manual to the Mesoscale Model Interface Program, Version 4.0.

US Wind intends to run AERCOARE using the following settings recommended in EPA's AERCOARE User's Guide, as specified below:

1. The default threshold wind speed will be used to identify calm hours (i.e., WSCALM = 0.5 m/s). Wind speeds below this value will be considered calms.
2. Mixing heights provided by WRF-MMIF will be used, instead of calculated by AERCOARE. The default minimum mixing height of 25 meters will be assigned.
3. Warm layer and cool-skin effects will not be considered.
4. Friction velocity will be determined from wind speed only; wave-height will not be considered.

AERCOARE parameters noted above were previously approved by EPA Regions 2 and 3 and EPA OAQPS in their approvals of the Alternative Model Request for the Dominion Coastal Virginia Offshore Wind-Commercial Wind Farm and Atlantic Shores Projects.

These actions should demonstrate that the protocol establishment element is adequately addressed.

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[3] See AERCOAREv1.0 User's Manual.

Conclusion

EPA Region 3 has reviewed MDE's alternative model request submittal and has determined that the proposed AERCOARE/AERMOD using WRF-MMIF prognostic meteorological data in their modeling approach is acceptable as an alternative model for the air quality impact analysis submitted in support of its OCS air permit application. We find that the proposed approach addresses the 5 elements contained in Section 3.2.2(e) of 40 CFR 51 Appendix W.

In accordance with Appendix W sections 3.0(b) and 3.2.2(a), Region 3 currently intends to approve the use of AERCOARE/AERMOD as an acceptable alternative model for the US Wind's Maryland Offshore Wind Project. We seek the concurrence from the Model Clearinghouse. As with the other alternative model approvals of AERMOD-COARE, approval to use this alternative model is made on a case-by-case basis. Should an air permit applicant or state desire to use AERCOARE/AERMOD in an overwater modeling analysis for a different facility and/or location, a request for alternative approval must be made to the appropriate EPA Regional Office containing the appropriate technical justifications/demonstrations consistent with applicable sections of Appendix W.

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Enclosure

cc: Cristina Fernández, Director, Air & Radiation Division
Gwen Supplee, Air & Radiation Division, Permits Branch

US Wind

March 10, 2023

Ms. Suna Y. Sariscak
Manager, Air Quality Permits Program
suna.sariscak@maryland.gov
Maryland Department of the Environment
1800 Washington Blvd.
Baltimore, MD 21230

Re: Request for Approval for Use of the Alternative Model AERMOD/AERCOARE and Revised Air Quality Modeling Protocol for Modeling of the Maryland Offshore Wind Project – US Wind, Inc.

Dear Ms. Sariscak:

US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project (the Project), an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within the area described in OCS-A 0490 (the Lease), a Lease area of approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10.0 nautical miles [nm]) off the coast of Maryland on the outer continental shelf (OCS). The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease area. The Project will be interconnected to the onshore electric grid by up to four (4) new 230-275 kV export cables into new onshore substations in Delaware. US Wind is required by the OCS Air Regulations in 40 Code of Federal Regulations (CFR) Part 55.4, to obtain an air permit for the proposed construction and operation and maintenance (O&M) of the Project.

In accordance with the United States Environmental Protection Agency's (EPA) Outer Continental Shelf (OCS) air regulations (40 CFR Part 55) and the Prevention of Significant Deterioration (PSD) permitting regulations (40 CFR Part 52.21), the Project expects to perform an ambient air impact analysis. Based on feedback from the Maryland Department of the Environment provided on December 27, 2022 in comments on the September 16, 2022 Air Quality Modeling Protocol, US Wind is hereby requesting approval to use AERMOD in conjunction with AERCOARE prepared meteorological data (AERCOARE/AERMOD) as an alternative model for assessing compliance with air quality standards for the Project emission sources located over water in lieu of the OCD model, which is the Guideline on Air Quality Models (40 CFR 51 Appendix W) preferred model for over-water dispersion. US Wind is also providing the attached revised Air Quality Modeling Protocol that addresses all of the MDE comments received on December 27, 2022, and proposes the use of AERCOARE/AERMOD.

Please contact me at 410-340-9428 or l.jodziewicz@uswindinc.com if you have any questions regarding this request.

Sincerely,

Laurie Jodziewicz
Senior Director of Environmental Affairs
US Wind, Inc.

Attachment: US Wind – Maryland Offshore Wind Project: Air Quality Modeling Protocol (Revised March 2023)

cc:

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Request for Approval for Use of the Alternative Model AERMOD/AERCOARE for Offshore Modeling of Maryland Offshore Wind Project - US Wind, Inc.

Introduction

US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project, an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within OCS-A 0490 (the Lease), a federal lease for offshore wind energy development on the OCS. The area within the Lease is approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10 nautical miles [NM]) off the coast of Maryland. The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease area. The Project would be interconnected to the onshore electric grid by up to four (4) new export cables into new onshore substations in Delaware.

The generation of offshore wind energy itself does not emit air contaminants. However, there will be air emissions associated with vessel engines and other equipment involved in the construction and operation and maintenance (O&M) of the Project. US Wind is subject to Prevention of Significant Deterioration (PSD) permitting and is required to submit an OCS Air Permit application that includes a dispersion modeling demonstration that air emissions from the Project will not cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS) or PSD increments. The NAAQS have been established for six pollutants designated by the EPA as "criteria pollutants". The criteria pollutants are carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2). PM is characterized according to size; PM having an effective aerodynamic diameter of 10 microns or less is referred to as PM_{10}, or "respirable particulate." PM having an effective aerodynamic diameter of 2.5 microns or less is referred to as $PM_{2.5}$, or "fine particulate"; $PM_{2.5}$ is a subset of PM_{10}.

This alternative model request addresses the proposed methodology to quantify the ambient air impacts resulting from the air emissions during Project construction and operation and maintenance (O&M) activities as required by the Maryland Department of the Environment (MDE) air regulations at 26 Code of Maryland Air Regulations (COMAR) 11.06.14. OCS source emissions are defined pursuant to 40 CFR Part 55 as emissions from OCS sources, which include certain vessels while attached to the seabed or to the Project, and certain vessels traveling to and from the Project when within 25 nautical miles (46.3 kilometers [km]) of the Project's center (the 25-NM [46.3 km] centroid or the OCS centroid). Construction of the Project would involve emission sources attached to and erected upon on the OCS; therefore, an air permit is required by the OCS permitting rules (40 CFR Part 55). US Wind intends to submit an application for a Nonattainment New Source Review (NNSR) and Prevention of Significant Deterioration (PSD) major source air permit from the MDE for the construction and O&M of the Project.

The Project is subject to both federal and state air quality regulations. Worcester County, Maryland is the nearest onshore area (NOA) for the Project, and as it is expected that the NOA will also be the designated corresponding onshore area (COA) per 40 CFR § 55.5. The Project will be subject to the applicable requirements of Title 26 of the COMAR Subtitle 11, which have been incorporated into 40 CFR Part 55 by reference and have been listed in Appendix A of the OCS Air Regulations. While the Project is subject to the federal OCS regulations as administered by MDE through an authorization by the United States Environmental Protection Agency (EPA), most of the Project is located within 25 NM of the NOA's seaward boundary, therefore the COA's applicable air quality rules must be addressed in addition to the federal rules that apply throughout the OCS. Figures 1a and 1b depict the distances from the centroid of the Project area to several nearby onshore locations.

Figure 1a. Distances to Corresponding Onshore Area

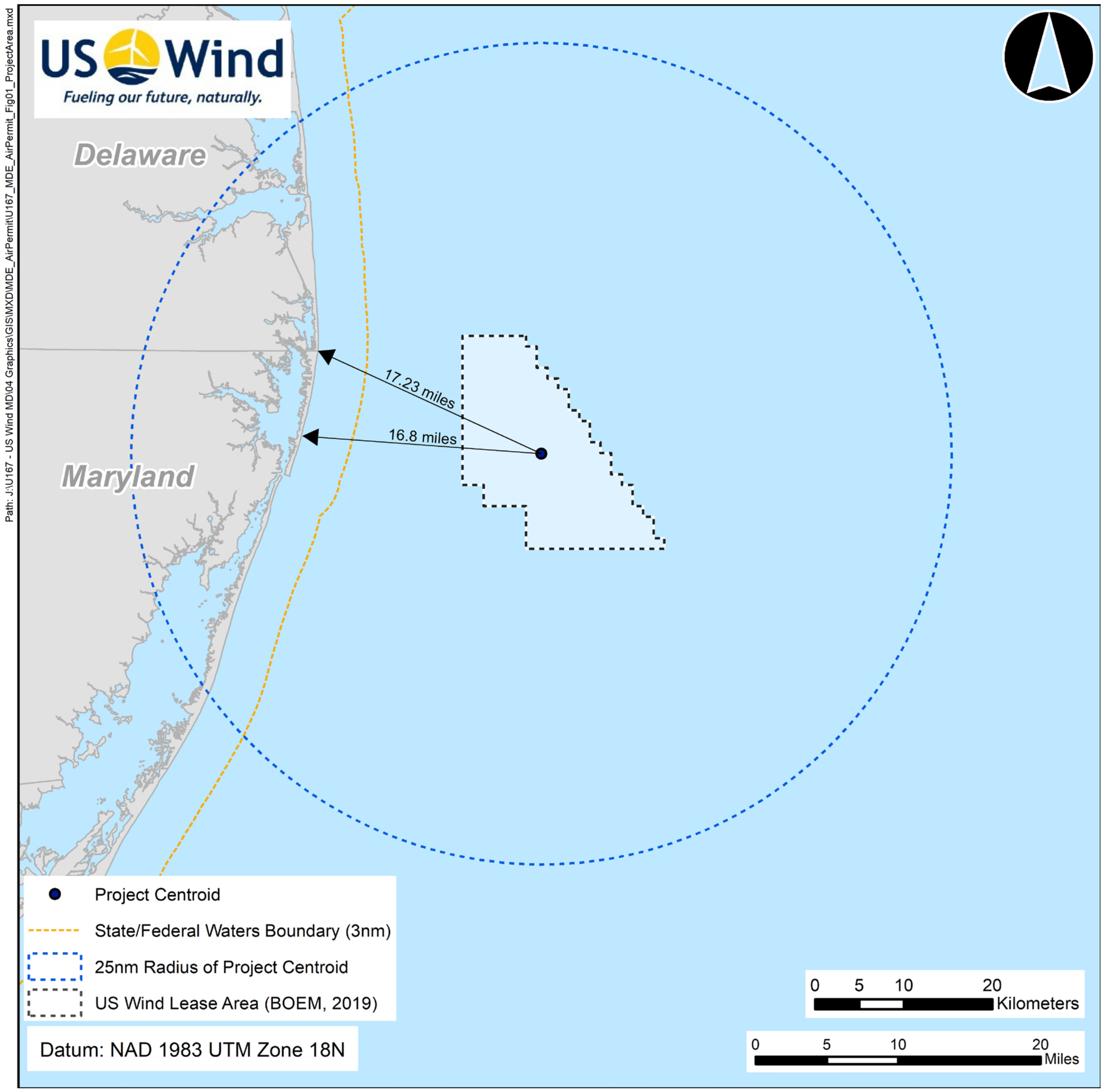
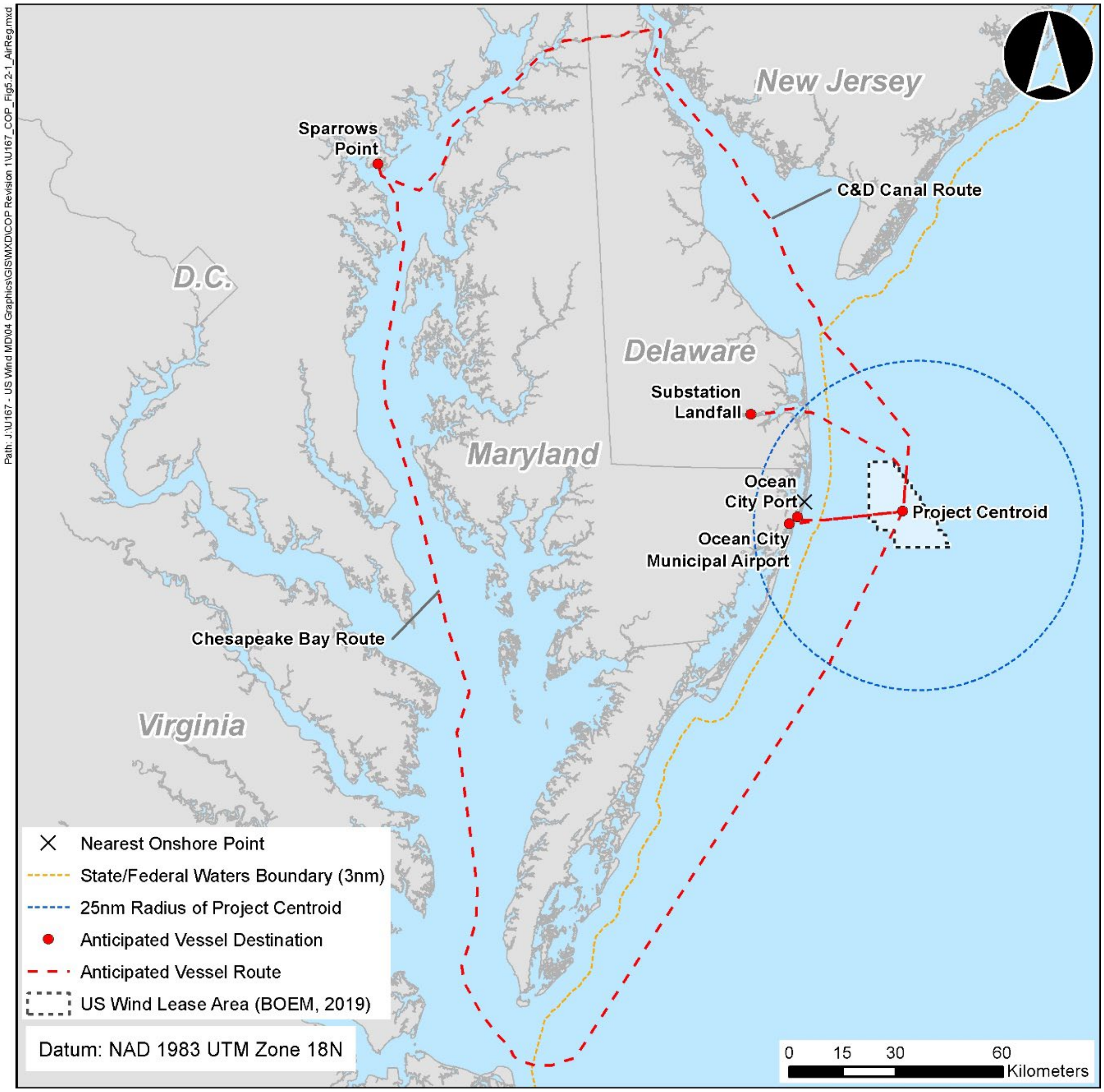


Figure 1b. Project Location of Maryland Offshore Wind Project



US Wind expects that emissions of one or more criteria air pollutants would exceed the pollutant specific PSD/NNSR significant emission rates (SER) and, consequently, an air dispersion modeling analysis will be required for these pollutants. Furthermore, an air quality assessment to determine the potential impact of the project emissions on the National Ambient Air Quality Standards (NAAQS) will be required. The air quality analysis will be required to demonstrate that the Project will be compliant with all applicable PSD increment levels and NAAQS.

EPA's Guideline on Air Quality Models[1] ("Guideline") lists the Offshore and Coastal Dispersion (OCD) model as the preferred model for over-water dispersion. As is discussed in this request, OCD contains limitations in model formulation, technical disadvantages, and implementation related issues for the proposed Project that justify the use of an alternative model. US Wind proposes to use the Coupled Ocean-Atmosphere Response

[1] https://www.epa.gov/sites/default/files/2020-09/documents/appw_17.pdf

Experiment (COARE) bulk flux algorithm as implemented within the AERCOARE program, which is intended for use within AERMOD, for this alternative model approval request. AERCOARE is requested as an alternative to replace the regulatory AERMET preprocessor program that is specifically designed for applications over land. The AERCOARE processor will read and process overwater meteorological data using the COARE methodology designed for marine applications. The output from AERCOARE can then be input to AERMOD for modeling applications in a marine environment.

The COARE bulk flux algorithm consists of equations that utilize air-sea temperature difference, overwater humidity and wind speed to parameterize the boundary layer parameters such as sensible heat, latent heat, and momentum fluxes. Although the COARE algorithm was originally developed based on measurements in the tropics, it has since been improved, expanding its applicability outside of tropical environments. The meteorological preprocessor, AERCOARE, which implements Version 3.0 of the COARE algorithms, is used to generate model-ready meteorological data for use with AERMOD, which is the current EPA preferred model for short-range (within 50 kilometers) dispersion modeling.

EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) lists AERCOARE[2] as an alternative model and states that the output from AERCOARE can be used by AERMOD in a marine environment.
The SCRAM website indicates that, an AERMOD-COARE approach was approved by EPA Region 10, with concurrence from the EPA Model Clearinghouse, as an alternative model to OCD for application in an Arctic ice-free environment. In that application, the COARE algorithm was applied to overwater measurements and the results assembled in a spreadsheet. AERCOARE replaces the need for post- processing with a spreadsheet, provides support for missing data, adds options for the treatment of overwater mixing heights, and can consider many different input data formats.

On April 1st, 2011, EPA Region 10 granted approval for the use of output from the COARE algorithm coupled with AERMOD to estimate ambient air pollutant concentrations in an ice-free marine environment[3,4]. Since the EPA Region 10 approval in May 2011, there have been eight (8) additional EPA Model Clearinghouse approvals to use AERMOD-AERCOARE. As enumerated below, all but one of the approvals are for offshore wind energy projects:

- November 2019, EPA Region 6, Sea Port Oil Terminal (SPOT), Gulf of Mexico
- January 2022, EPA Region 1, Vineyard Wind, OCS off the coast of Martha's Vineyard, MA
- July 2022, EPA Region 1, Park City Wind, OCS off the coast of Martha's Vineyard, MA
- July 2022, EPA Region 2, Empire Wind, OCS off the coast of Long Island, New York
- July 2022, EPA Region 2, Atlantic Shores, OCS off the coast of New Jersey
- November 2022, EPA Region 3, Dominion Coastal Virginia Offshore Wind-Commercial wind farm project, OCS off the coast of Virginia
- December 2022, EPA Region 1, Beacon Wind, OCS off the coast of Massachusetts
- December 2022, EPA Region 1, Mayflower Wind, OCS off the coast of Massachusetts

As documented in all of the recent approvals (including the most representative of the US Wind Maryland

2 https://www.epa.gov/scram/air-quality-dispersion-modeling-related-model-support-programs

3 COARE Bulk Flux Algorithm to Generate Hourly Meteorological Data for Use with the AERMOD Dispersion Program; Section 3.2.2.e Alternative Refined Model Demonstration, Herman Wong, EPA to Tyler Fox, EPA, April 1, 2011.

4 Model Clearinghouse Review of AERMOD-COARE as an Alternative Model for Application in an Arctic Marine Ice-Free Environment, George Bridgers, EPA to Herman Wong, EPA, May 6, 2011.

Project, which is the Dominion Coastal Virginia Offshore Wind Project off the coast of Virginia), the AERCOARE-AERMOD model was approved for use in an arctic marine ice-free environment because it satisfied the five criteria contained in Section 3.2.2.e of EPA's Guideline. In each concurrence memorandum, the EPA Model Clearinghouse stated that its concurrence with the approvals did not constitute a generic approval of AERCOARE-AERMOD for other applications. US Wind's alternative model approval request for use of AERCOARE-AERMOD follows the format of previous requests.

Based on the proposed Project location, recent approvals of AERCOARE-AERMOD in the same geographic region, and the following technical advantages, options, and features available in the model, AERCOARE-AERMOD is being proposed as the preferred model in this request.

1. The Plume Rise Model Enhancements (PRIME) downwash algorithm can be used to assess impacts in the cavity and wake regions of structures. While the AERMOD model does not incorporate platform downwash, US Wind has proposed use of PRIME considering the platform as a solid structure which will result in conservative, overprediction of concentrations.

2. The use of EPA Tier 2 and 3 NO_X modeling options are not available in OCD but could be utilized with an AERCOARE-AERMOD approach. Specifically, the Ambient Ratio Method (ARM2), Plume Volume Molar Ratio Method (PVMRM) and Ozone Limiting Method (OLM) could be used by the Project to estimate the conversion of NO_X to NO_2.

3. Output can be generated in the statistical form that is needed to assess compliance with the newer percentile-based NAAQS, such as 1-hour NO_2, SO_2 and 24-hour $PM_{2.5}$.

4. AERMOD-AERCOARE has the capability of handling a wider array of source configurations and does not limit the number of modeled sources compared to OCD, including multiple line sources, and more than 5 areas sources within the same model run.

5. The AERMOD-AERCOARE model can model volume sources, whereas OCD cannot.

6. Calm wind conditions can be processed by the AERMOD-AERCOARE model, whereas OCD cannot.

7. The dispersion algorithms used in the AERMOD portion of AERCOARE-AERMOD are considered state-of-art by EPA. OCD dispersion algorithms have not been updated to account for current advancements in boundary layer physics.

8. AERCOARE-AERMOD does not have a limit on the number of receptors that can be considered in an analysis, whereas OCD does limit the total number of receptors.

9. AERCOARE has the capability to utilize prognostic data from the Weather Research and Forecasting (WRF) model and output from the Mesoscale Model Interface (MMIF) program.

10. AERMOD incorporates options for the inclusion of varying ambient background concentrations by season and hour of day during the model run. In contrast, OCD does not have an option to incorporate ambient background concentrations within the model. Ambient background concentrations could be applied to the OCD predicted concentrations in a postprocessing step. A custom postprocessor for OCD would need to be developed.

11. Unlike OCD, AERMOD does not include algorithms to evaluate shoreline fumigation conditions. However, shoreline fumigation is not expected to be an important impact consideration for the Project emission sources. Shoreline fumigation can occur when plumes traveling in relatively stable air near the shoreline encounter the thermal internal boundary layer (TIBL) and fumigate downward, potentially resulting in elevated pollutant concentrations at the ground. The TIBL is the boundary layer that can form between the more stable over-water air mass and the less stable over-land air mass and typically forms during sea breeze conditions. EPA modeling guidance indicates that shoreline fumigation can be an important phenomenon on and near the shoreline of bodies of water for sources with tall stacks located on or just inland of a shoreline. However, the Project emissions (primarily vessels) are emitted from stacks with low release heights that will generally be located far offshore (the Project site is located 18.5 km offshore). Exhaust plumes are expected to be substantially dispersed before encountering the TIBL and potential fumigation conditions. Therefore, shoreline fumigation is not expected to be an important impact condition for Project emissions and is not proposed to be specifically evaluated for the air quality analysis.

Alternative Model Justification

Section 3.2.2 of EPA's Guideline provides an approach for approval of an alternative model to determine whether it is more appropriate for a given application. Section 3.2.2 states that the request for an alternative approach must meet one of the following three (3) conditions:

1. If a demonstration can be made that the model produces concentration estimates equivalent to the estimates obtained using a preferred model;
2. If a statistical performance evaluation has been conducted using measured air quality data and the results of that evaluation indicate the alternative model performs better for the given application than a comparable model; or
3. If the preferred model is less appropriate for the specific application, or there is no preferred model.

US Wind's alternative model approval request falls under Condition 3 because OCD, the preferred model, is less appropriate due to practical and theoretical model formulation issues needed for the proposed Project application. However, Condition 1 also applies because according to overwater field studies[5], the performance of AERCOARE-AERMOD has been found to be comparable to OCD making it a suitable alternative model for regulatory applications.

AERCOARE-AERMOD includes model formulations that reflect more advanced atmospheric dispersion science compared to the OCD model. However, OCD currently has some capabilities that AERCOARE-AERMOD modeling approach does not including:

1. OCD can simulate platform downwash – In place of OCD's simulation, US Wind will utilize the PRIME downwash algorithm in AERMOD to account for downwash from the offshore substation platforms as a solid structure.

2. OCD can simulate shoreline fumigation - Shoreline fumigation is not a concern for this Project given the distance from the Lease area to the coastline, and therefore the simulation is not necessary.

To justify the application of an alternative model under Condition 3 in Appendix W, Section 3.2.2.e, the

[5] AERCOARE: An Overwater Meteorological Preprocessor for AERMOD, Wong, Herman, et. al, Journal of the Air & Waste Management Association, 2016, Vol 66, No 11, 1121-1140.

alternative model must meet the following conditions:

1. The model has received a scientific peer review;
2. The model can be demonstrated to be applicable to the problem on a theoretical basis;
3. The data bases which are necessary to perform the analysis are available and adequate;
4. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and
5. A protocol on methods and procedures to be followed has been established.

US Wind provides the following justification for each of the five elements contained in Section 3.2.2.e.

1. The model has received a scientific peer review.

The EPA Region 10 approval from April 2011 indicates that the COARE model formulation implemented into AERCOARE has been published in multiple peer-reviewed journals[6]. In its approval, EPA Region 10 confirmed the scientific legitimacy and applicability of the COARE algorithm to various over-water conditions through a sufficient body of peer-reviewed literature. The EPA Region 10 approval also documented that the algorithms in COARE are configured to handle a wide range of temperature gradient conditions including the extremes that could be found in the Arctic or the tropics.

EPA has also supported a peer-reviewed study that evaluates AERCOARE-AERMOD performance when using inputs from a prognostic meteorological model. The study examines the use of meteorological inputs from WRF-MMIF, performed similarly to AERCOARE-AERMOD modeling using measured data from buoys, in most scenarios. The poorest performing cases in this study were attributed to bias and error in the prognostic dataset due to low-resolution ocean-surface temperature data[7].

2. The model can be demonstrated to be applicable to the problem on a theoretical basis.

The EPA Region 10, April 2011 approval along with the eight (8) additional approvals contain similar documentation which justifies that the COARE algorithm is applicable on a theoretical basis.

The documentation included in approvals is contained below:

"Version 3.0 of the COARE algorithm with journal references and a User's Manual can be accessed at: ftp://ftp.etl.noaa.gov/users/cfairall/wcrp_wgsf/computer_programs/cor3_0/ and http://www.coaps.fsu.edu/COARE/flux_algor/

These references provided copies of the code, descriptions of the scientific basis for the code, and detailed descriptions on how to use the COARE program. However, Shell acknowledges that COARE was not specifically designed to provide an input file for AERMOD, and there are certain steps that must be taken to produce the input files for AERMOD.

Communication with Ken Richmond of ENVIRON and marine boundary layer experts Dr. Andrey Grachev and Dr. Chris Fairall from the National Oceanic and Atmospheric Administration (NOAA) provided the following insight:

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[6] http://www.coaps.fsu.edu/COARE/

[7] Combined WRF/MMIF/AERCOARE/AERMOD Overwater Modeling Approach for Offshore Emission Sources, Vol. 2. EPA 910-R-15-001b, October 2015.

From Dr. Chris Fairall:

The original COARE version (2.5) (and the 2003 version (3.0)) was set up so that it could handle water and air temperatures from the tropics to the Arctic. Parameters such as the kinematic viscosity of air have T dependencies. I have listed below a few references to Arctic applications I dug up.

Minimum meteorological variables needed to run the COARE algorithm are the wind speed, the sea surface temperature, the air temperature, and some form of humidity measurement (e.g., relative humidity, absolute humidity, dew point, and wet bulb temperature). Barometric pressure, precipitation, and a typical mixed layer height are also input variables that can be provided or assigned by COARE default parameters. If options are selected for warm-layer heating and/or cool- skin effects, then solar radiation and downward longwave radiation are needed. Shell is not planning to invoke these options but has tested and provided a framework for the provision of these variables using measured solar radiation, cloud cover and ceiling height. COARE also contains several options for the surface roughness length based on wave period and wave height. Shell plans to use the default option that does not need these variables."

The current AERCOARE User Manual also states:

"AERCOARE uses Version 3.0 of the COARE algorithm that has been updated several times since the initial international TOGA-COARE field program in the western Pacific Ocean from November 1992 to February 1993. The basic algorithm uses air-sea temperature difference, overwater humidity, and wind speed measurements to estimate the sensible heat, latent heat, and momentum fluxes. The original algorithm was based on measurements in the tropics with winds generally less than 10 m/s but has since been modified and extensively evaluated against measurements in high latitudes with winds up to 20 m/s. Based on these studies, AERCOARE is expected to be appropriate for marine conditions found at all latitudes including the Arctic."

Review of Fairall et al 2003 shows that Version 3 of the COARE algorithm was developed in part based on data obtained during the Fronts and Atlantic Storms Experiment (FASTEX) dataset; the FASTEX dataset was obtained in part off the coast of New Brunswick, Canada.

The limitations of the algorithms that OCD uses have been documented by the EPA in the AERCOARE User's Manual V1.0:

"The current EPA guideline model for offshore sources is the OCD model. OCD has not been updated for many years and several of the dispersion model components and procedures are not consistent with AERMOD. The AERMOD modeling system is the U.S. EPA-recommended approach for assessing the near-source (< 50 km) impacts of new or modified sources as part of the New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs. The modeling system includes an AERMET meteorological processor that processes overland meteorological data for input to AERMOD.

Important routines in OCD that are independent of the onshore/offshore setting are inconsistent with current regulatory practices as embodied within AERMOD, namely:

- *OCD does not contain routines for processing either missing data or hours of calm meteorology. Such processing must be performed with a custom post-processing program.*
- *OCD does not contain the latest regulatory PRIME downwash algorithm (Schulman, L. L. et al,*

2000). Many offshore sources are located on ships where downwash effects are important.

- *The PVMRM and OLM methods are not included in OCD. These techniques are crucial for assessing the new 1-hour NO_2 ambient standard.*
- *The new 24-hour $PM_{2.5}$, 1-hour NO_2, and 1-hour SO_2 ambient standards are based on the 98th, 98th, and 99th percentile concentrations, respectively. These probabilistic standards and the EPA methods recommended for estimating design concentrations must be obtained by post-processing the hourly OCD output files. Such calculations are included in AERMOD.*
- *OCD does not contain a volume source routine and the area source routine only considers circular areas without allowance for any initial vertical dispersion.*
- *Although OCD contains routines to simulate the boundary layer over the ocean, the surface energy flux algorithms are outdated and have been replaced within the scientific community by the COARE air-sea flux algorithms."*

In the 2022 AERCOARE/AERMOD approvals for the Atlantic Shores and Coastal Virginia Offshore Wind Projects, EPA Regions 1 and 2 deemed it was appropriate on a theoretical basis for use in the marine environment off the coast of New Jersey and Virginia.

Based on this justification, AERMOD-AERCOARE is applicable to the US Wind application on a theoretical basis.

3. The data bases which are necessary to perform the analysis are available and adequate.

The database to perform that evaluation of AERCOARE as an alternative model are available and accurate:

"The four model evaluation data sets used in the current study were provided by EPA R10 from the archives supporting development of the MMS (BOEM) version of CALPUFF and OCD Version 4 (DiCristofaro and Hanna, 1989). These studies occur under a wide range of overwater atmospheric stabilities that might be expected in coastal waters regardless of the latitude. The tracer measurements in Pismo Beach and Cameron occur in level terrain near the shoreline downwind of offshore tracer releases. These two studies provide tests of overwater dispersion without the complications due to air modification over the land or complex terrain. The Ventura study is similar; however, the receptors are located 500 meters (m) to one kilometer (km) inland from the shoreline, so some air modification may have affected dispersion in this study. The Carpinteria complex terrain tracer study involved shoreline measurements observed on a bluff near plume level. The Carpinteria data set had much lighter winds and the transport distances were less than the other three studies."

The EPA Region 10 approval in May 2011 indicated the following with respect to the limited tracer study data in its application to an arctic marine environment:

"R10 is aware that there are not tracer gas experiments for every geographic region, climatic region, or synoptic region for use in a performance evaluation. That includes the Arctic region. Nonetheless, R*10 determined the three tracer gas experiments are acceptable because of the similarity of the tracer gas experiment and marine Arctic sea-surface temperatures and as discussed below."*

The following is a passage from Shell's 11 March 2011 response to the R10 Technical Staff AERMOD-COARE Information and Data Request dated 07 March 2011 (Shell 2011b).

"The selection of experiments to use in the model evaluation was extensively discussed with EPA throughout the fall of 2010. Originally, Shell has selected only the Pismo Beach, CA and Cameron, LA experiments for the evaluation using based on the shoreline, near sea-level location of the receptors. At the specific request of EPA,

the Carpinteria, CA experiment was added. Shell suggested at the time that the Carpinteria experiment was not appropriate since the setting involved receptors on a bluff located on the coastline, a setting not seen in the Arctic. The Carpentaria experiment was also more a test of the complex terrain algorithms, not over water dispersion. However, Shell included the Carpinteria experiments at EPA's request. No mention or request was made by EPA at that time to include either the Ventura, CA experiments or the Oresund experiments. The reason for not including the Ventura, CA experiments was that receptors in that case were well inland and no longer reflected the marine environment. The COARE-AERMOD approach is not equipped to simulate changes in the meteorology along the path of the plume. The Oresund experiments were never used in any previous OCD evaluation. They were only used in earlier CALPUFF evaluations. Shell felt that the differences in the use of CALPUFF, principally a long-range transport model, and AERMOD, used for within 50 kilometers, made this comparison less relevant. In addition, the other experiments had already been prepared for OCD and that made it straightforward to adapt them to evaluation with the COARE-AERMOD approach. With the Oresund experiments, the input data were in CALPUFF format and transforming these data to a format for the COARE-AERMOD approach would involve a number of assumptions and judgments that could ultimately impact the results. Shell's concern was that the results of the evaluation could depend on these assumptions and judgments rather than the true model performance."

Further, EPA Region 1 requested that additional data be provided for the August 9, 2021, alternative model request for Park City Wind. The additional data requested was to support that the argument that the development of the COARE algorithms occurred using data sets with similar observations patterns (i.e., wind speed and air/sea temperature difference) representative of the project area off the New England coast. Based on the additional data provided by Park City Wind, which is included Attachment 2 of EPA Region 1's technical Review of the Vineyard Wind alternative model approval request, EPA Region 1 concluded the following in their technical review:

"Region 1 concludes the meteorological datasets used to develop AERCOARE and the four tracer studies used in the evaluation are sufficiently available and adequate for determining the effectiveness of the modeling approach."

There are four comprehensive historical overwater dispersion datasets available in the record that involve study of air pollutant dispersion in the marine atmospheric boundary layer. The following four tracer gas studies from the 1980s have been used in performance evaluations of OCD, CALPUFF, and AERCOARE/AERMOD:

1. Cameron, Louisiana: July 1981 and February 1982 (Dabberdt, Brodzinsky, Cantrell, & Ruff, 1982[8])
2. Carpinteria, California: September 1985 (Johnson & Spangler, 1986[9])
3. Pismo Beach, California: December 1981 and June 1982 (Schacher, et al., 1982[10])
4. Ventura, California: September 1980 and January 1981 (Schacher, et al., 1982)

The EPA Region 10 alternative model approval of AERCOARE/AERMOD utilized tracer gas experiments from the four studies listed above. In all of the previous approvals, EPA determined that these datasets were adequate for verification of the AERCOARE/AERMOD system.

[8] Dabberdt, W., Brodzinsky, R., Cantrell, B., & Ruff, R. (1982). Atmospheric Dispersion Over Water and in the Shoreline Transition Zone, Final Report Volume II: Data. Menlo Park, CA: Prepared for American Petroleum Institute by SRI International.
[9] Johnson, V., & Spangler, T. (1986). Tracer Study Conducted to Acquire Data for Evaluation of Air Quality Dispersion Models. San Diego, CA: WESTEC Services, Inc. for the American Petroleum Institute
[10] Schacher, G., Spiel, D., Fairall, C., Davidson, K., Leonard, C., & Reheis, C. (1982). California Coastal Offshore Transport and Diffusion Experiments: Meteorological Conditions and Data. Monterey, CA: Report NPS-61-82-007

Additional information was provided by Vineyard Wind to Region 1 to demonstrate the referenced tracer studies were sufficiently representative of the marine environment off the coast of Massachusetts. Likewise, US Wind provides statistics for key observed meteorological parameters for the Ocean City Inlet Buoy station and Delaware Bay 26 NM Buoy station (#44009) located in the Project area. US Wind requested prognostic (i.e., WRF data) data from EPA Office of Air Quality Planning and Standards (OAQPS) which was received on February 9, 2023. EPA processed the WRF data using the MMIF (Version 4.0) to convert the WRF prognostic meteorological data (2019-2021) into a format suitable for dispersion modeling applications. The WRF Data was provided for the following points in Table 1. US Wind is also providing statistics for key WRF meteorological parameters for the nearest WRF nodes to the Ocean City Inlet Buoy station, Delaware Bay 26 NM Buoy station (#44009), Ocean City ASOS, and Project Centroid.

Table 1: Meteorological Extraction Points and WRF Grid Point Locations

Data	Latitude	Longitude	Comment
Overwater extraction point for AERCOARE/AERMOD Modeling	38.3467	-74.7605	Corresponds to the Project Centroid
Delaware Bay 26 NM Buoy - OBS	38.460	-74.692	~14 km northeast of Project Centroid
Ocean City Inlet Buoy - OBS	38.328	-75.091	~29 km west of Project Centroid
Ocean City Airport ASOS - OBS	38.309	-75.123	~32 km west of Project Centroid
Ocean City Airport ASOS – WRF	38.327	-75.140	Nearest WRF node to Ocean City Airport ASOS
Delaware Bay 26 NM Buoy - WRF	38.460	-74.671	Nearest WRF node to Delaware Bay 26 NM Buoy
Ocean City Inlet Buoy - WRF	38.327	-75.140	Nearest WRF node to Ocean City Inlet Buoy
Project Centroid - WRF	38.354	-74.704	Nearest WRF node to Project Centroid

Table 2 summarizes key meteorological data and compares them to data from the tracer studies. The data demonstrates that the range of atmospheric conditions that typically occur in the Ocean City, Maryland offshore region fit the range of conditions used to develop and verify the COARE 3.0 algorithm.

Table 2: Comparison of Meteorological Data Summary Statistics

Location	Observations	Range	10th Percentile	25th Percentile	Median	Average	75th Percentile	90th Percentile
	Wind Speed (m/s)							
Cameron, LA	**26**	**2.1 to 6.2**	**3.5**	**3.7**	**4.6**	**4.5**	**5**	**5.7**
Carpinteria, CA	**27**	**1 to 5.4**	**1**	**1.4**	**2.4**	**2.5**	**3.2**	**3.9**
Pismo Beach, CA	**31**	**1.6 to 12.7**	**2.7**	**3.9**	**5.6**	**6.1**	**8.3**	**9.9**

	Observations	Range	10th Percentile	25th Percentile	Median	Average	75th Percentile	90th Percentile
Ventura, CA	17	3.1 to 6.9	3.7	4.2	4.9	5	5.8	6.2
OBS - Delaware Bay, DE	27,187	0 to 23.1	2.3	3.9	5.9	6.3	8.3	10.8
OBS - Ocean City Inlet, MD	40,897	0 to 19.0	1.5	2.4	3.7	4.1	5.5	7.3
WRF - Delaware Bay, DE	26,299	0.1 - 24.3	2.9	4.4	6.6	6.9	9.1	11.6
WRF - Ocean City, MD	26,299	0.1 - 17.9	2.1	3.0	4.3	4.5	5.8	7.3
WRF – Project Centroid	26,299	0.1 - 24.5	2.8	4.4	6.6	6.9	9.0	11.5
WRF – Ocean City ASOS, MD	26,299	0.1 - 17.9	2.1	3.0	4.3	4.5	5.8	7.3
	Air/Sea Temperature Difference (K)							
Cameron, LA	26	-4.5 to 5	-2.7	-1.6	0.5	0.3	1.9	4.2
Carpinteria, CA	27	-1.1 to 2.8	-0.8	-0.7	-0.4	0.2	1	2.2
Pismo Beach, CA	31	-0.8 to 3.7	0.0	0.4	1.3	1.3	2.2	3.2
Ventura, CA	17	-2.1 to 1.8	-2.0	-1	0	-0.2	0.4	1.6
OBS - Delaware Bay, DE	27,187	-16.1 to 8.2	-4.7	-2.0	-0.4	-1.1	0.7	1.5
OBS - Ocean City Inlet, MD	40,897	-15.3 to 17.1	-4.8	-2.2	-0.2	-0.5	1.4	3.2
WRF - Delaware Bay, DE	26,299	-14.1 - 7.0	-4.4	-1.7	-0.1	-0.7	0.8	1.7
WRF - Ocean City, MD	26,299	-18.1 - 14.0	-6.1	-2.7	0.2	-0.5	2.0	3.8
WRF – Project Centroid	26,299	-14.4 - 6.8	-4.4	-1.6	-0.1	-0.7	0.8	1.7
WRF – Ocean City ASOS, MD	N/A – Land Based Meteorological Station							

The observed Delaware Bay and Ocean City Inlet buoy air-sea temperature gradient data and wind data from the period 2017-2021 were obtained for comparison to the range of conditions used to develop the COARE 3.0 algorithm and the conditions during the four tracer experiments. Data statistics are provided on the distribution of wind speed and air-sea temperature differences from the four tracer studies, consisting of a total of 101 hourly observations. The maximum hourly average wind speed measured at the Delaware Bay buoy was 23.1 m/s and the 99.9th percentile of wind speed was 18.4 m/s. The maximum hourly average wind speed measured at the Ocean City Inlet buoy was 19.0 m/s. The COARE algorithm was developed and verified with conditions up to 20 m/s. Therefore, more than 99.9 percent of the observed Delaware Bay offshore winds are within the COARE evaluation wind speed range and 100 percent of the observed Ocean City offshore winds are within the COARE evaluation wind speed range. The highest wind speeds that exceed the values in the COARE evaluation range will be associated with highly dispersive conditions such that maximal predicted concentrations will not be a consideration at the wind speeds in excess of the range.

The WRF data air-sea temperature gradient data and wind data from the period 2019-2021 were obtained as discussed above for comparison to the range of conditions used to develop the COARE 3.0 algorithm and the conditions during the four tracer experiments. The maximum hourly average wind speed at the Delaware Bay buoy (WRF) was 24.3 m/s and the 99.9th percentile of wind speed was 18.6 m/s. The maximum hourly average wind speed at the Project Centroid (WRF) was 24.5 m/s and the 99.9th percentile of wind speed was 18.4 m/s. The maximum hourly average wind speed at the Ocean City Inlet buoy (WRF) and Ocean City ASOS (WRF) was 17.9 m/s. The COARE algorithm was developed and verified with conditions up to 20 m/s. Therefore, more than 99.9 percent of the WRF modeled Delaware Bay and Project Centroid offshore winds are within the COARE evaluation wind speed range and 100 percent of the WRF modeled Ocean City Inlet offshore winds and Ocean City ASOS surface winds are within the COARE evaluation wind speed range.

The maximum wind speed in the four tracer studies was 12.7 m/s, during the Pismo Beach study. Average wind speeds during each study ranged from 2.5 to 6.1 m/s. Average observed wind speed at the Delaware Bay and Ocean City Inlet buoys was 6.3 m/s and 4.1 m/s, respectively. The average WRF modeled wind speeds ranged from 4.5 m/s to 6.9 m/s. Highest concentrations from the Project are likely to occur during lower wind speeds. The range of wind speed conditions observed during the tracer experiments covers the range of conditions when the maximum project concentrations are expected.

Because the air-sea temperature difference is an important parameter in characterizing the marine boundary layer, a comparison of the observed air-sea temperature difference at the Delaware Bay and Ocean City buoys was made with the air-sea temperature differences observed in the evaluation tracer studies. Additionally, a comparison of the WRF modeled air-sea temperature differences at the Delaware Bay and Ocean City buoys, and Project Centroid was made with the air-sea temperatures observed in the evaluation tracer studies. Thus, the datasets were examined visually using box and whisker plots. Box and whisker plots are one way of comparing datasets to ascertain the distribution.

The box and whisker plots for observed wind speed for Delaware Bay, Ocean City Inlet, and the four validation datasets were plotted, and broadly they show that wind speeds at Delaware Bay and Ocean City are moderately higher than those observed during the validation studies. Additionally, the box and whisker plots for the WRF modeled wind speed for the Delaware Bay and Ocean City Inlet Buoys and Project Centroid broadly show similar results to the observed data. This is one reason the COARE algorithm utilized the Fronts and Atlantic Storm (FASTEX) dataset as it generally contained higher wind speeds than were observed at tropical latitudes. In other words, the COARE algorithm implemented into AERCOARE was specifically evaluated against a higher wind speed dataset to make it more globally applicable. The Box and Whisker Plots for Wind Speed are shown in Figures 2a through 2f.

Similarly, box and whisker plots were used to examine the distribution of the observed air/sea temperature difference between Delaware Bay, Ocean City, and the four validation studies. The median of the Delaware Bay and Ocean City datasets is similar to the median air/sea temperature difference in the four validation studies and the 25th and 75th percentiles are similar to what was measured during the validation studies. Additionally, the box and whisker plots for the WRF modeled air-sea temperature differences for the Delaware Bay and Ocean City Inlet Buoys and Project Centroid broadly show similar results to the observed data. The air/sea temperature difference seen in the mid-Atlantic is similar to what was observed during the validation studies. The box and whisker plots for air/sea temperature difference are shown in Figures 3a through 3e. The four tracer studies evaluated do cover a range of wind and temperature gradient conditions and represent the majority of the range of conditions that occur at the Project site, as inferred through the Delaware Bay and Ocean City datasets. Most importantly, the low wind speed conditions that are most likely to result in highest predicted concentrations are well addressed in the tracer studies.

Based on the information above: that the databases available occur under a wide range of overwater atmospheric stabilities that might be expected in coastal waters regardless of the latitude, the COARE algorithm implemented in AERCOARE was developed to be applicable for water temperatures from the tropics to the arctic, the COARE algorithm has been validated against a local meteorological datasets to specifically account for those conditions. It can be concluded that the necessary datasets to evaluate the AERCOARE are available and are adequate and that the meteorological inputs needed to populate AERCOARE are available and adequate.

Figure 2a: Box and Whisker Plots for OBS - Delaware Bay 26 NM Buoy and 4 Tracer Study Data Sets – Wind Speed (m/s)

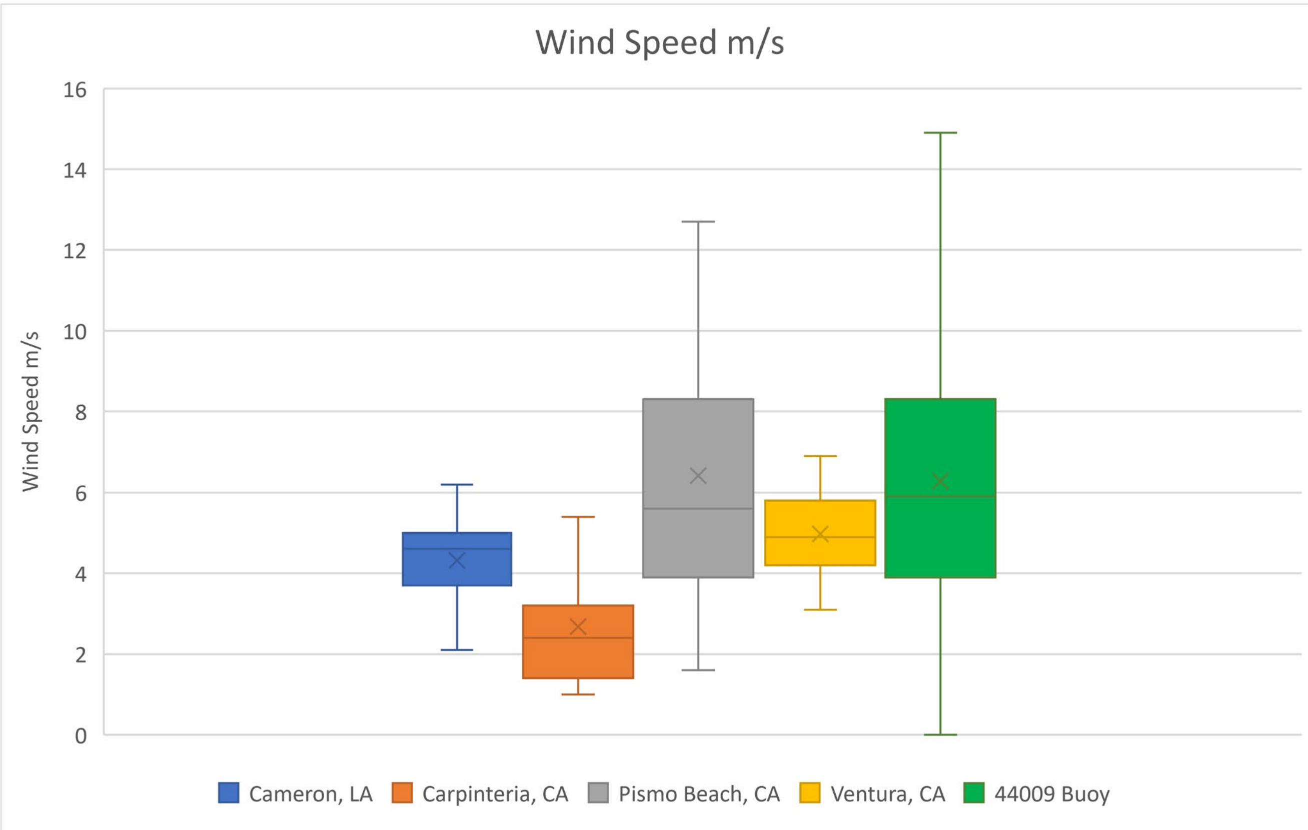


Figure 2b: Box and Whisker Plots for OBS - Ocean City Inlet and 4 Tracer Study Data Sets – Wind Speed (m/s)

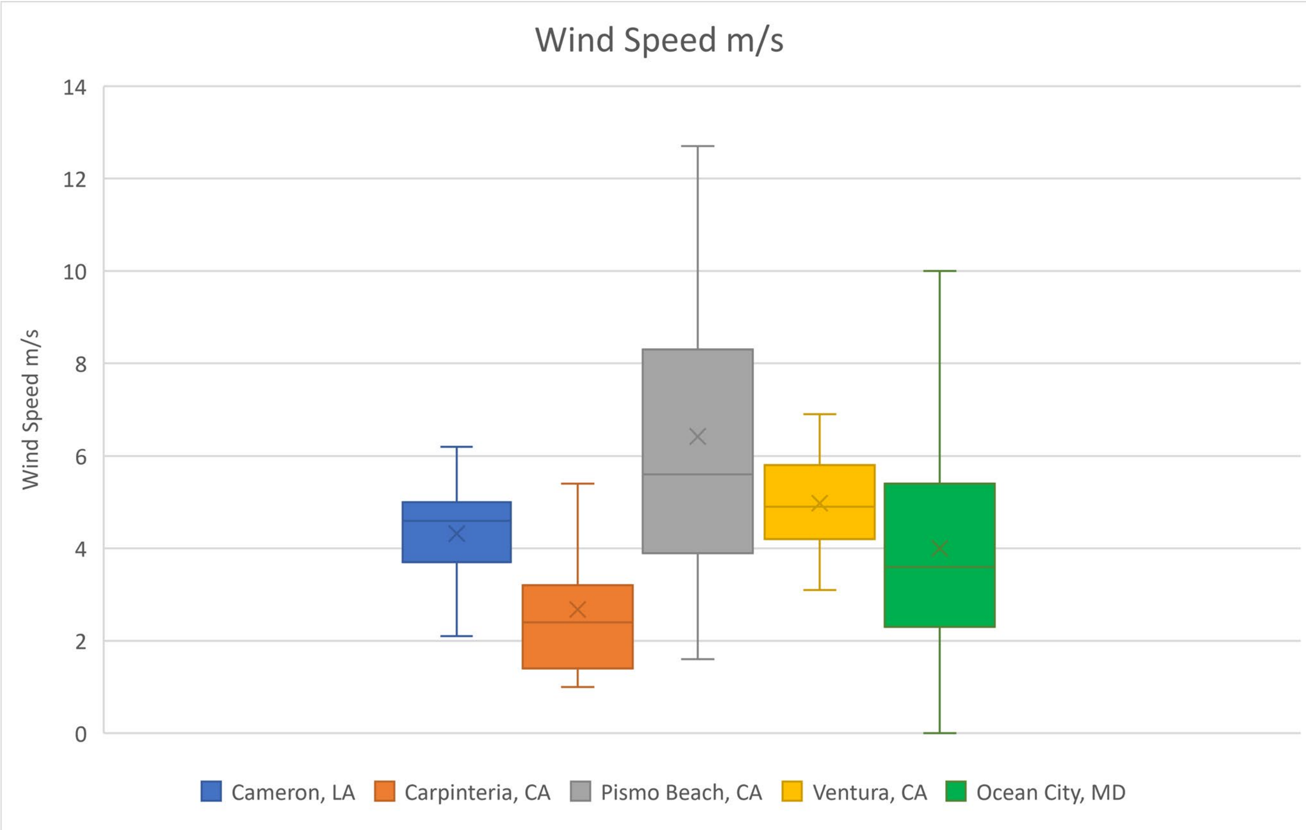


Figure 2c: Box and Whisker Plots for WRF - Delaware Bay 26 NM Buoy and 4 Tracer Study Data Sets – Wind Speed (m/s)

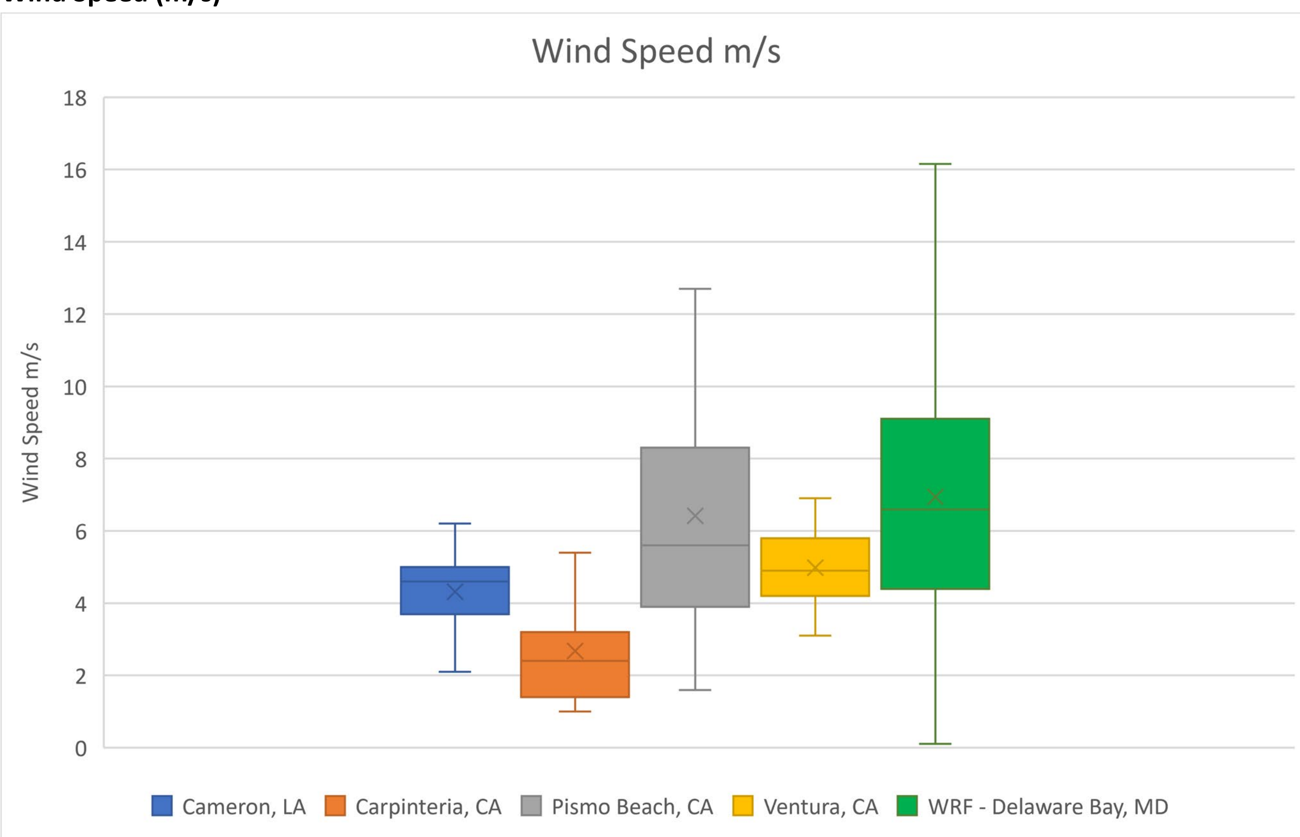


Figure 2d: Box and Whisker Plots for WRF - Ocean City Inlet and 4 Tracer Study Data Sets – Wind Speed (m/s)

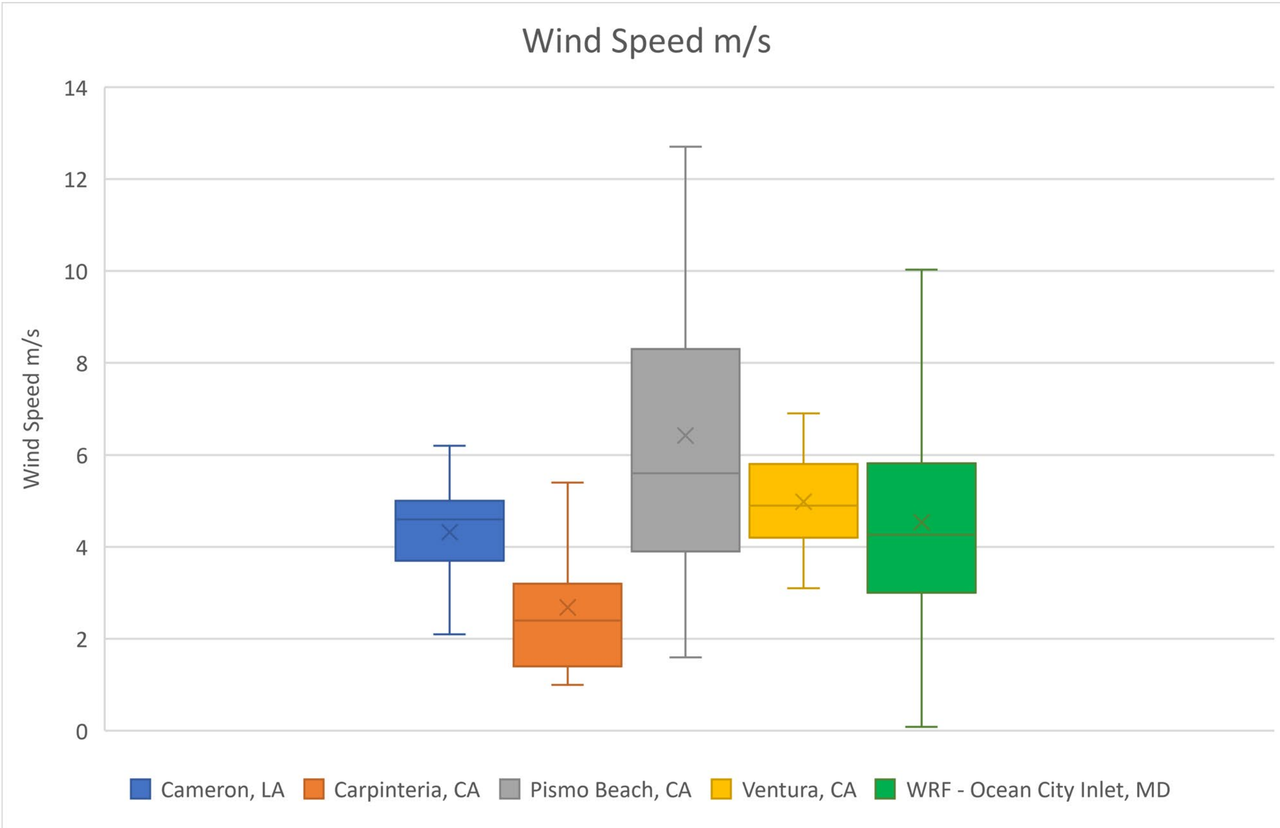


Figure 2e: Box and Whisker Plots for WRF – Project Centroid and 4 Tracer Study Data Sets – Wind Speed (m/s)

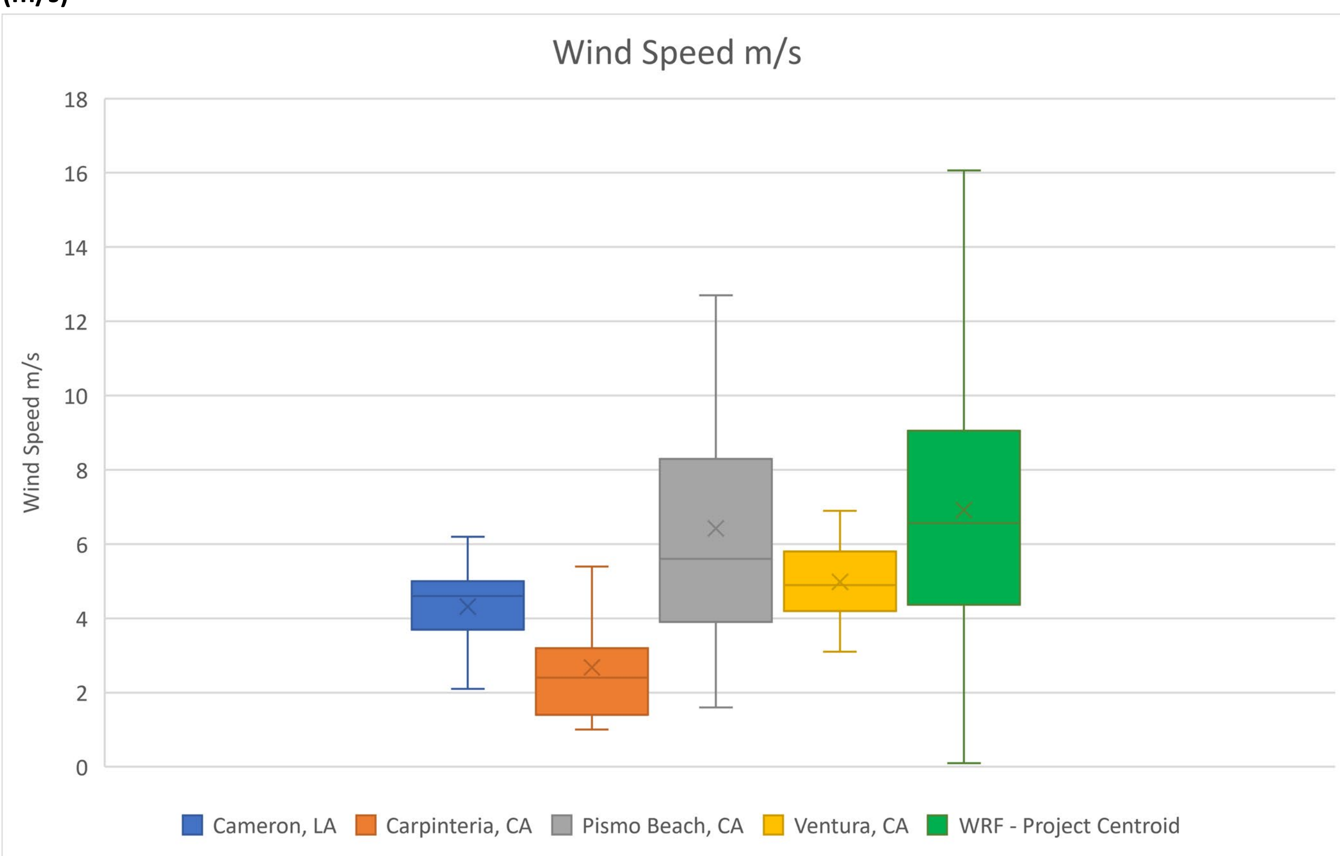


Figure 2f: Box and Whisker Plots for WRF – Ocean City ASOS and 4 Tracer Study Data Sets – Wind Speed (m/s)

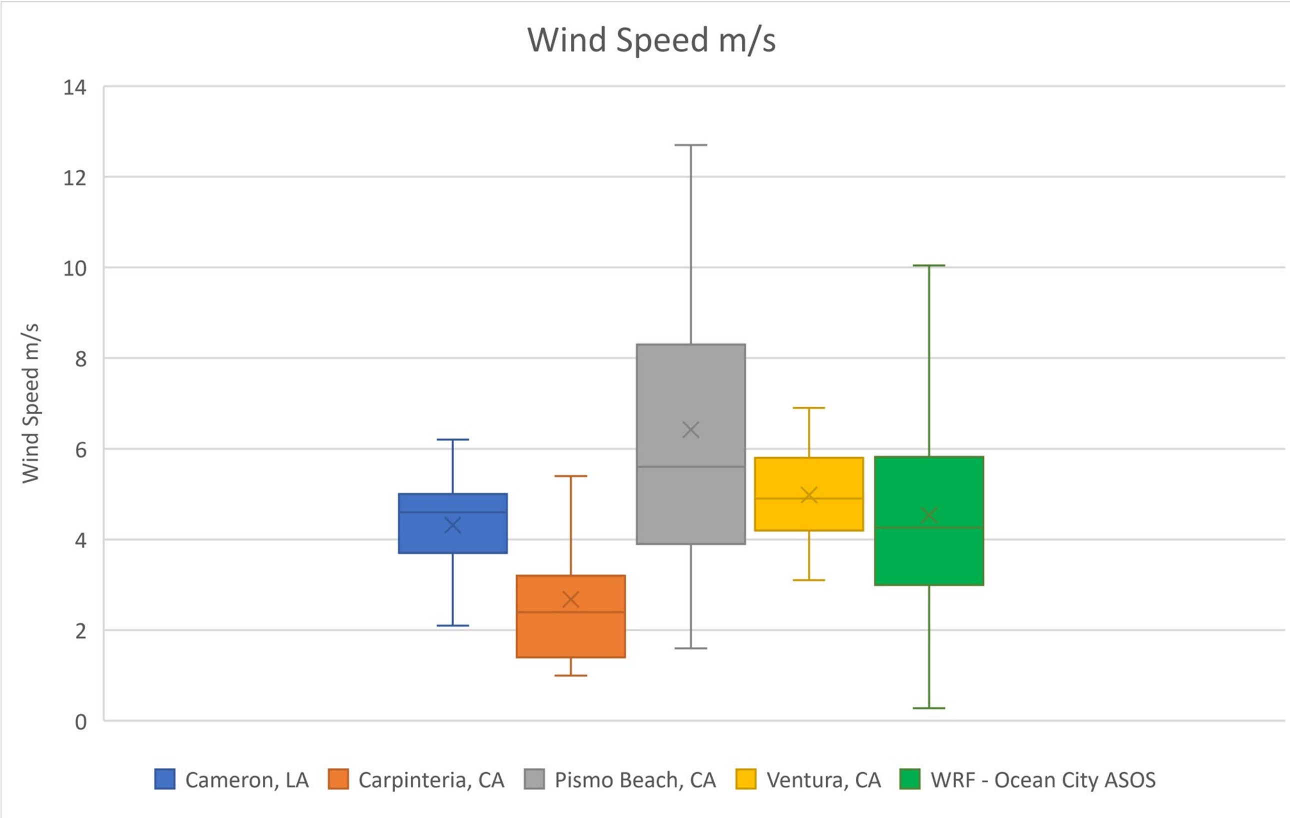


Figure 3a: Box and Whisker Plots for OBS - Delaware Bay 26 NM Buoy and 4 Tracer Study Data Sets – Air-Sea Temperature Difference (K)

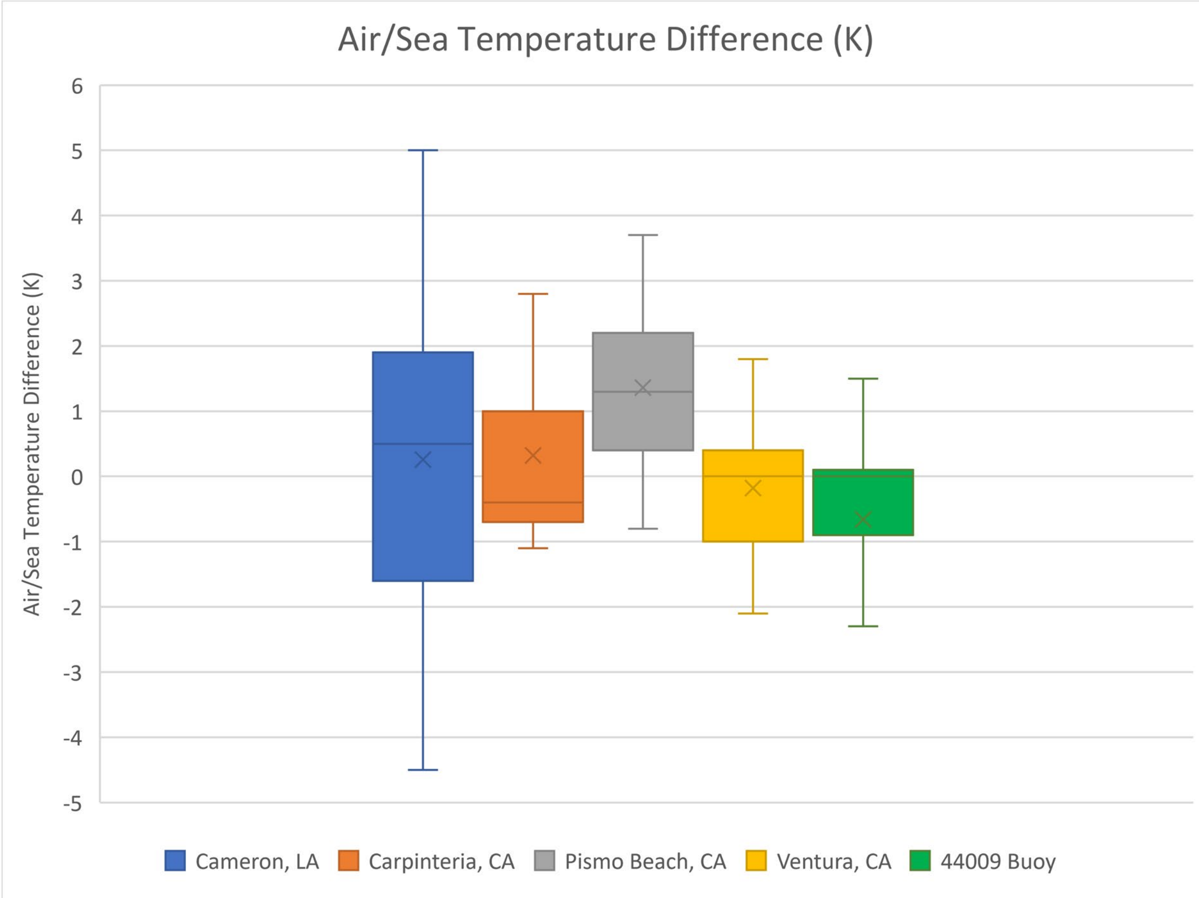


Figure 3b: Box and Whisker Plots for OBS - Ocean City and 4 Tracer Study Data Sets – Air-Sea Temperature Difference (K)

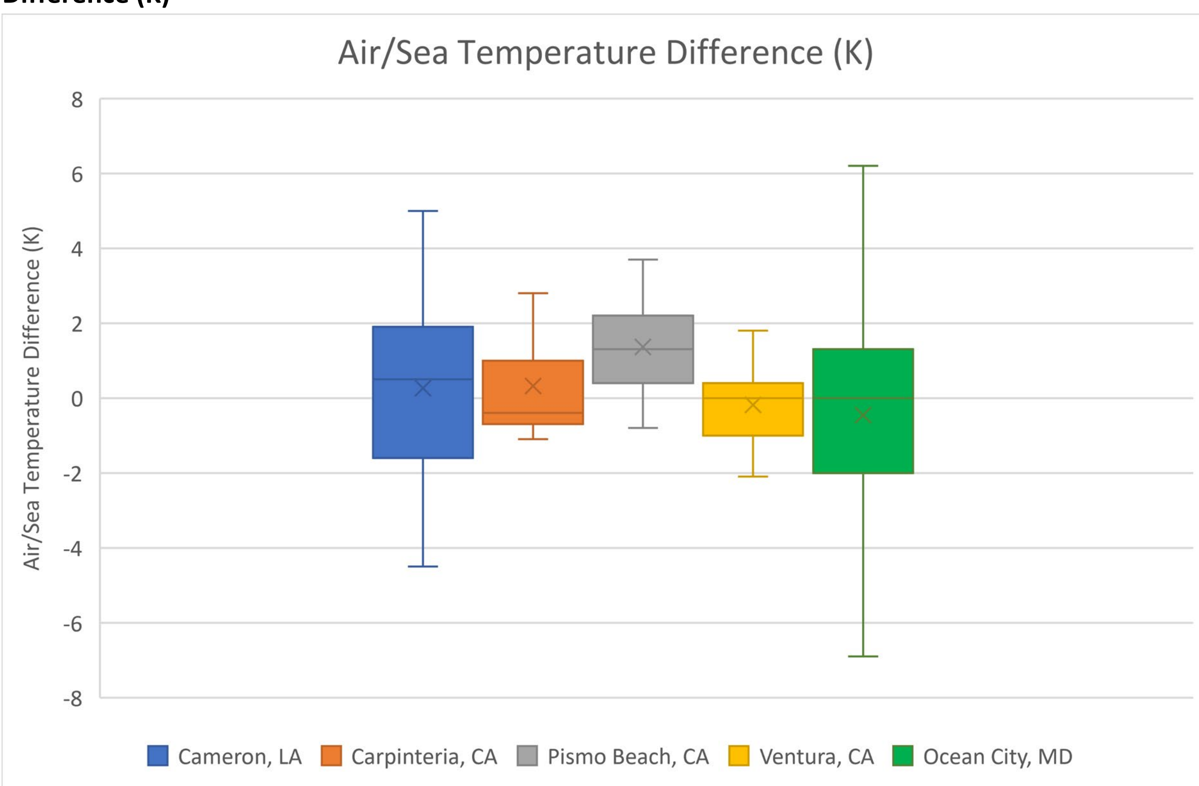


Figure 3c: Box and Whisker Plots for WRF - Delaware Bay 26 NM Buoy and 4 Tracer Study Data Sets – Air-Sea Temperature Difference (K)

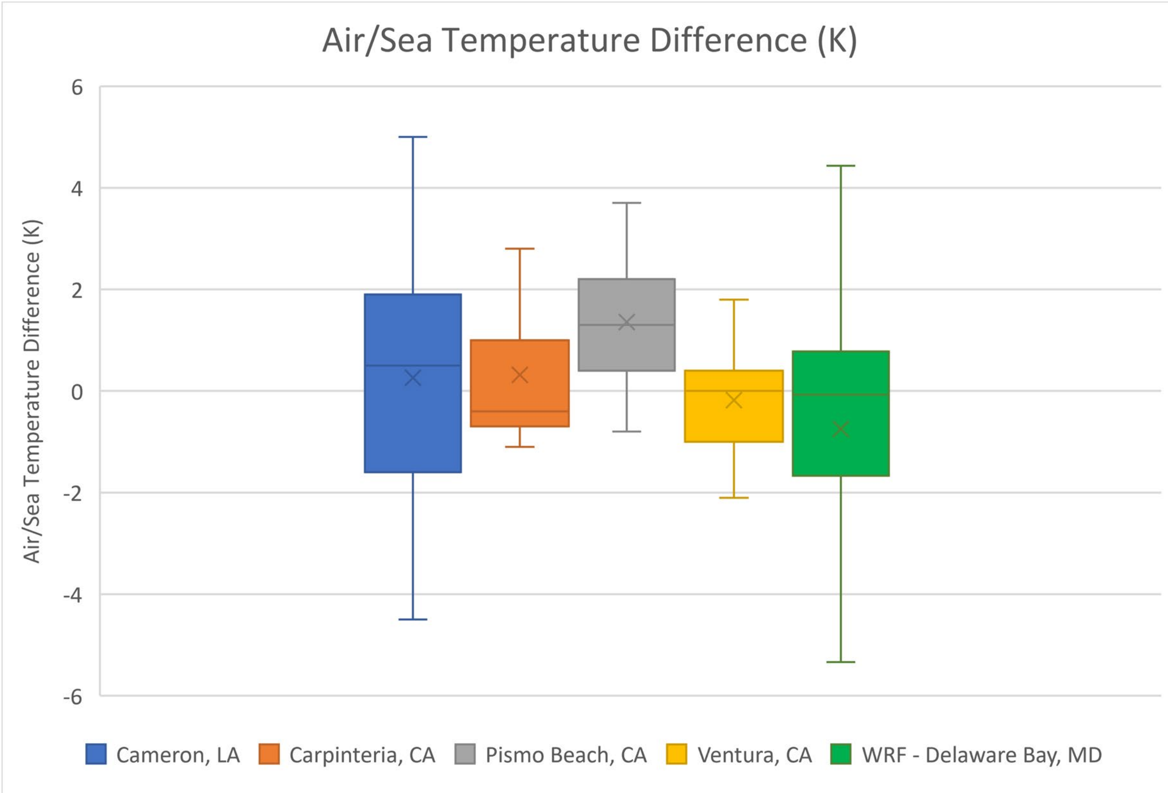


Figure 3d: Box and Whisker Plots for WRF - Ocean City Inlet and 4 Tracer Study Data Sets – Air-Sea Temperature Difference (K)

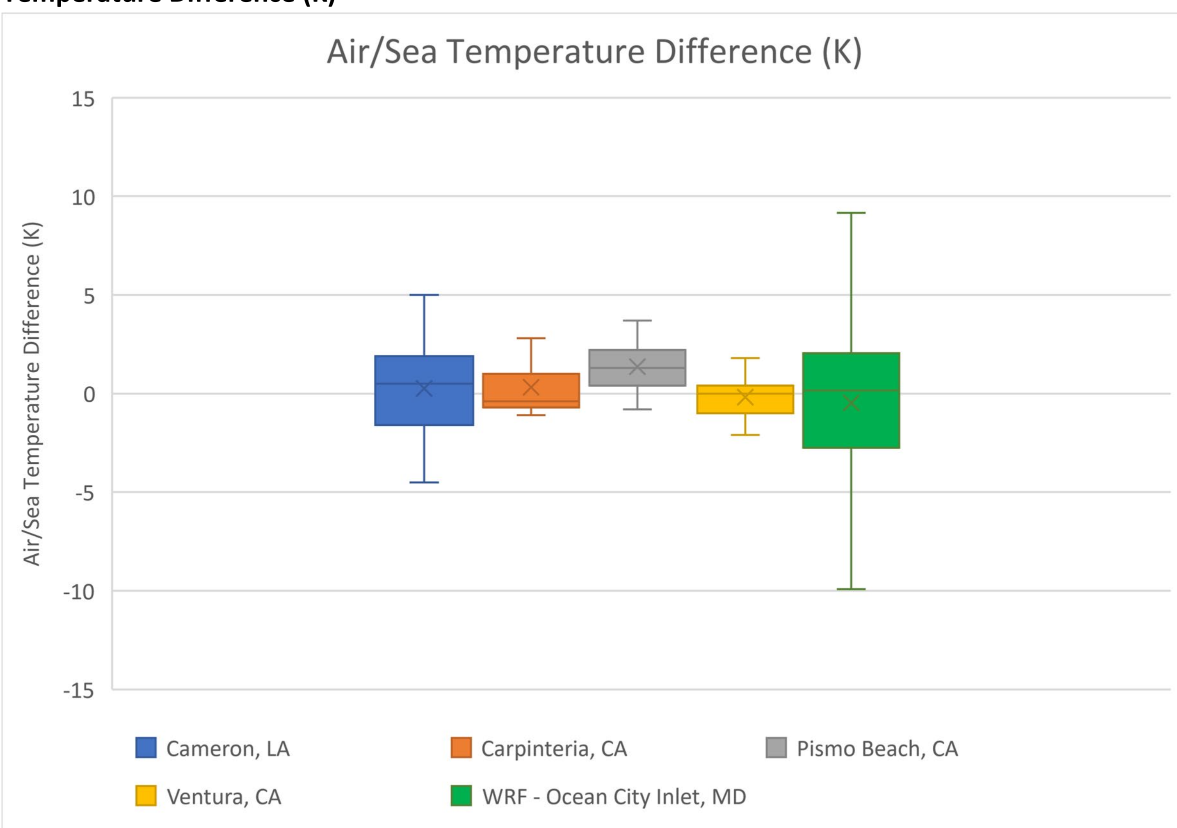
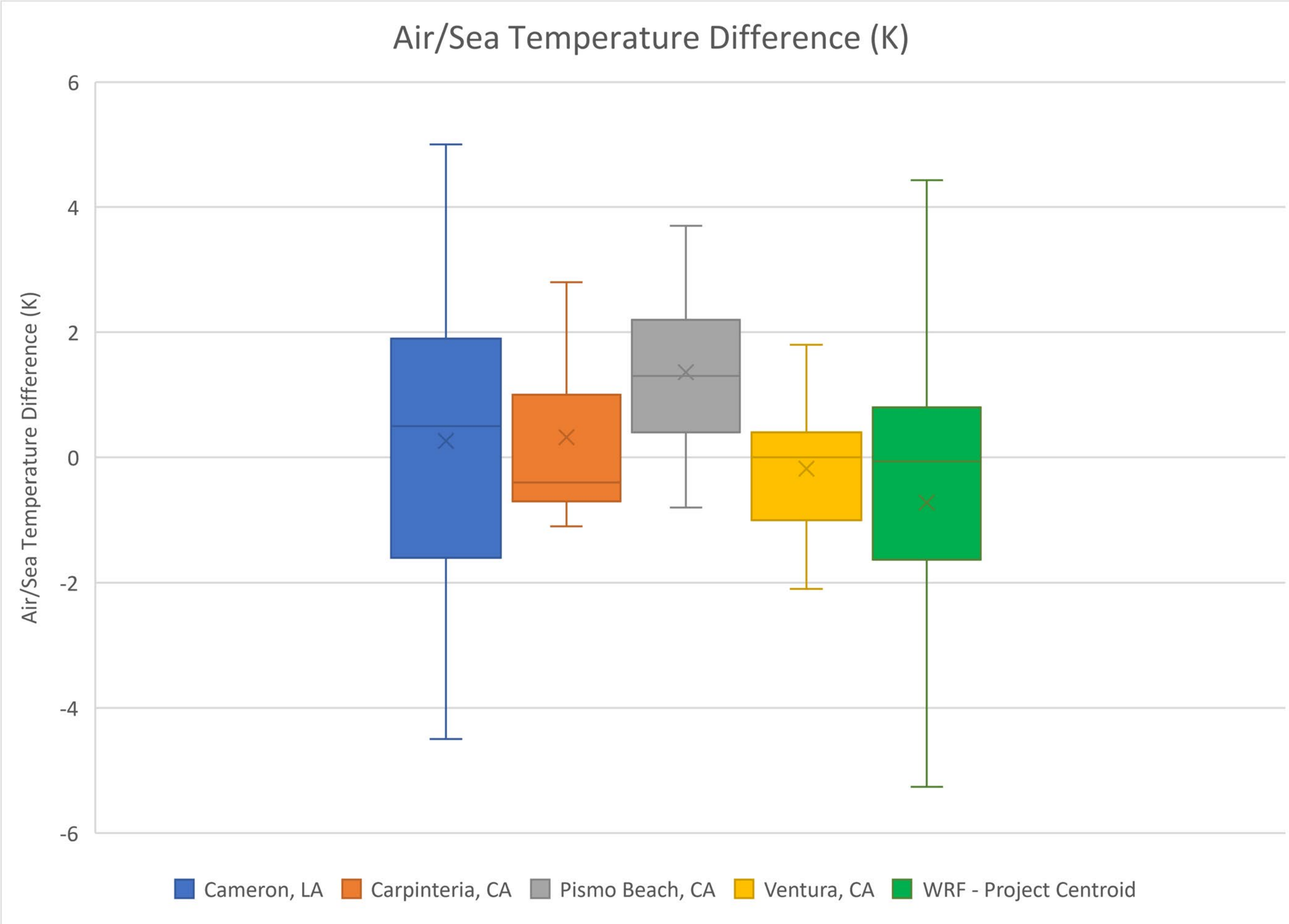


Figure 3e: Box and Whisker Plots for WRF – Project Centroid and 4 Tracer Study Data Sets – Air-Sea Temperature Difference (K)



4. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates.

Model evaluation results for AERCOARE were presented in detail in two documents: (1) April 1, 2011, memorandum from EPA Region 10 and (2) EPA/ENVIRON October 2012 Model Evaluation Study. The results of both model performance evaluations indicated the model is not biased toward underestimates as discussed below.

As documented in the October 2012 Model Evaluation Study, AERCOARE Version 1.0 (12275) was applied to prepare the overwater meteorological data for the Cameron, Louisiana, and the Pismo Beach, California offshore datasets. AERCOARE simulations were conducted using five different methods for the preparation of the meteorological data, including the estimation of mixing heights, the use of horizontal wind direction (sigma theta data), and limitations on other variables provided to AERMOD to calculate concentrations from the field studies.

For both evaluation studies, AERMOD was run using AERCOARE along with default options for rural flat terrain for both simulations. Quantile-quantile (Q-Q) plots were prepared based on a comparison of independently ranked modeled versus observed concentrations. A Q-Q plot is a useful tool for determining if a model has an underprediction bias especially at the upper end of the observed concentration profile. Figure

4 and Figure 5 provide Q-Q plots for the Cameron, Louisiana, and Pismo Beach, California datasets, respectively. The AERCOARE-AERMOD modeled concentrations are biased toward over-prediction for the highest concentrations, with less than a factor of 2 underprediction bias at the lower concentrations. Importantly, AERCOARE-AERMOD does not appear to be biased toward underestimates for the higher end of the frequency distribution, regardless of the five different meteorological preparation options examined in this study.

In EPA Region 1's review of Park City Wind, examination of whether the use of prognostic meteorological data generated by WRF could result in systematic underprediction of concentrations lead to the following conclusions:

"Additionally, Region 1 reviewed U.S. EPA (2015) to see if the WRF-MMIF inputs for AERCOARE resulted in underprediction. U.S. EPA (2015) used the four overwater dispersion study datasets listed above to compare AERCOARE/AERMOD predicted concentrations against the measured concentrations from the campaigns. This study also compared results across a set of combinations of WRF-MMIF inputs and settings. The results of this study show AERCOARE/AERMOD driven by WRF-MMIF inputs resulted in the high-end of the distribution of concentrations exceeding the measured concentrations in the Pismo and Ventura studies. Concentrations agreed well for the Carpinteria study at the high-end of the distribution in most cases. In the Cameron study, and under some of the scenarios in the Carpinteria study, the modeling resulted in underpredictions at the high-end of the distribution in some scenarios. Namely, when mixing heights were diagnosed by MMIF, instead of using the mixing heights directly from WRF, AERCOARE/AERMOD concentrations were underpredicted in some cases. The model runs using WRF-simulated mixing heights performed better, when compared to measured concentrations. Overall, however, the U.S. EPA (2015) study noted concentration bias could be attributed mainly due to error in sea-surface temperatures output from the WRF model.

A key element to both the original Region 10 approval study and the U.S. EPA (2015) study was an evaluation of the sensitivity of the modeling results to a minimum mixing height. The Region 10 approval found AERCOARE/AERMOD results were highly overpredicted when using AERMOD's default minimum mixing height of 1 meter. EPA Region 10's sensitivity study, summarized in ENVIRON (2012) found a minimum mixing height of 25 meters for overwater applications was more physically realistic and resulted in better model performance. The EPA Region 10 approval allowed for the use of a minimum mixing height of 25 meters for the application of AERCOARE/AERMOD and a minimum limit on the absolute value of Monin-Obukhov Length of 5 meters. These limits are recommended in the EPA's AERCOARE User's Guide[11].

Based on the findings from the studies reviewed in the prior EPA approvals and the additional WRF-MMIF-based study, Region 1 concludes it is evident the AERCOARE/AERMOD approach does not result in systematic underprediction of concentrations. Instead, the evidence more likely leads to the conclusion the approach is conservative."

US Wind proposes to use 12-km WRF data and MMIF for 2019-2021. The proposed AERCOARE settings will include the recommendations of 25 meters for the minimum mixing height and a minimum Monin-Obukhov length of 5 meters.

5. A protocol on methods and procedures to be followed has been established.

US Wind submitted a modeling protocol on September 16, 2022, to MDE proposing the use of the OCD model.

[11] https://gaftp.epa.gov/Air/aqmg/SCRAM/models/related/aercoare/AERCOAREv1_0_Users_Manual.pdf

The modeling protocol included a description of modeling methodologies and procedures consistent with the Guideline on Air Quality Models (Appendix W of 40 CFR 51). The modeling protocol has been updated to reflect the use of AERCOARE-AERMOD, which was submitted concurrently to MDE and EPA with this alternative model request.

US Wind requested prognostic (i.e., WRF data) data from EPA Office of Air Quality Planning and Standards (OAQPS) which was received on February 9, 2023. EPA processed the WRF data using the MMIF (Version 4.0) to convert the WRF prognostic meteorological data (2019-2021) into a format suitable for dispersion modeling applications. The EPA utilized the default settings for AERCOARE processing (i.e., settings specific to AERMET are not applicable) as provided in the User's Manual to the Mesoscale Model Interface Program, Version 4.0 (June 9, 2022).

US Wind intends to run AERCOARE using the following settings recommended in EPA's AERCOARE User's Guide, as specified below:

1. The default threshold wind speed will be used to identify calm hours (i.e., WSCALM = 0.5 m/s). Wind speeds below this value will be considered calms;
2. Mixing heights provided by WRF-MMIF will be used, instead of calculated by AERCOARE. The default minimum mixing height of 25 meters will be assigned.
3. Warm layer and cool-skin effects will not be considered.
4. Friction velocity will be determined from wind speed only; wave-height will not be considered.

The AERCOARE parameters noted above were previously approved by EPA Regions 2 and 3 and EPA OAQPS in their approvals of the Alternative Model Request for the Dominion Coastal Virginia Offshore Wind-Commercial Wind Farm and Atlantic Shores Projects.

Conclusions

The justification contained herein supports the use of AERCOARE-AERMOD as an alternative model, in lieu of OCD, for the US Wind Project. Based on this justification and recent precedents for approving AERCOARE-AERMOD in the Atlantic OCS, US Wind proposes the use of AERCOARE-AERMOD as an alternative model for the OCS air permit application. As shown above, the proposed approach satisfies each of the five elements contained in Section 3.2.2(e) of the Guideline required for alternative model approvals. US Wind requests MDE's and EPA's concurrence on this request for approval.

Figure 4: QQ Plot of AERCOARE versus Cameron, Louisiana, Tracer Study Results

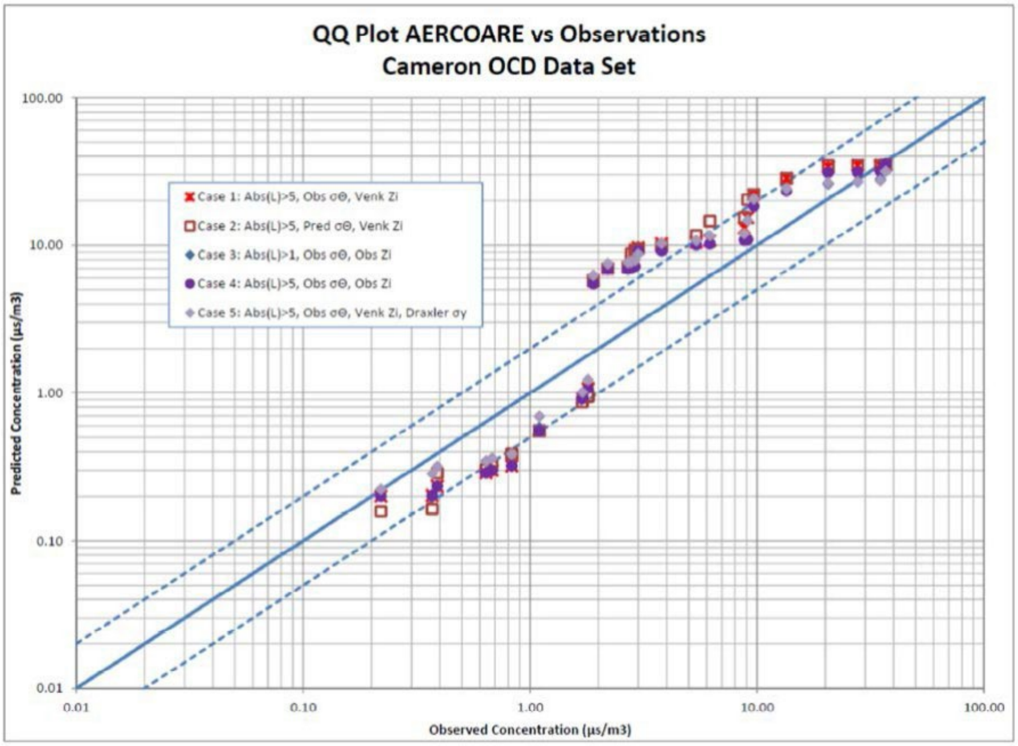
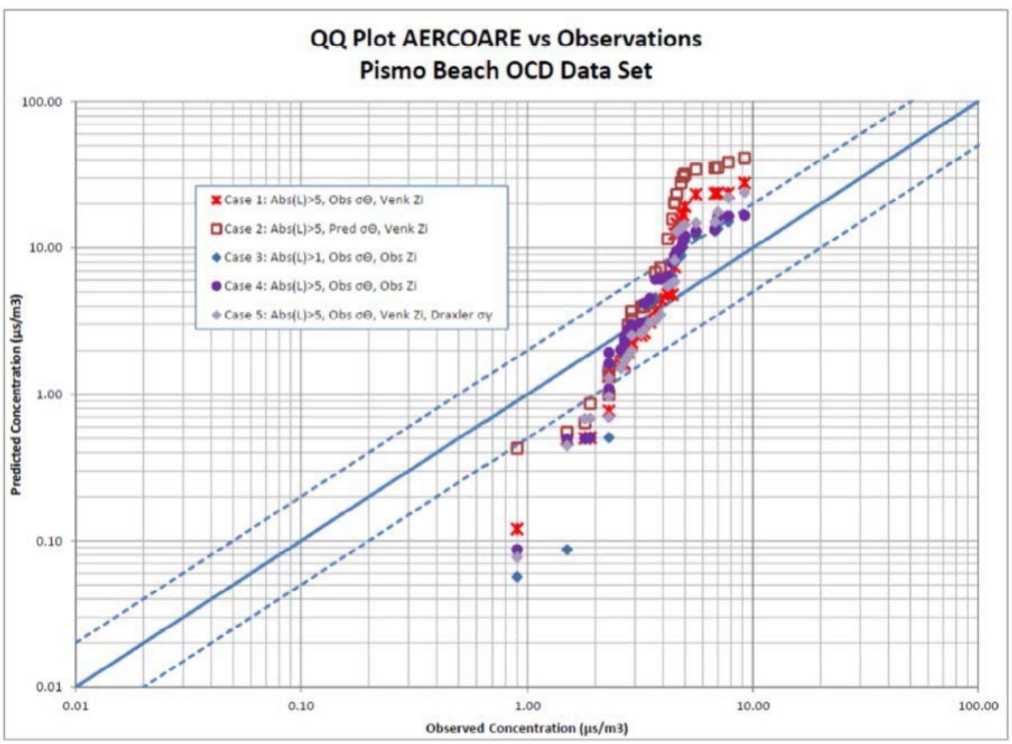


Figure 5: QQ Plot of AERCOARE versus Pismo Beach, California, Tracer Study Results



B-3
MDE Air Quality Modeling Protocol and Responses to MDE Comments

Maryland Offshore Wind Project

Air Quality Modeling Protocol

September 2022
Revised - March 2023

Prepared For:

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1.0 INTRODUCTION

US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project (the Project), an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within OCS-A 0490 (the Lease Area), a Lease Area of approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10.0 nautical miles [nm]) off the coast of Maryland on the outer continental shelf (OCS). The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease Area. The Project will be interconnected to the onshore electric grid by up to four (4) new 230-275 kV export cables into new onshore substations in Delaware. US Wind is required by the OCS Air Regulations in 40 Code of Federal Regulations (CFR) § 55.4, to obtain an air permit for the proposed construction and operation and maintenance (O&M) of the Project.

The Project is scheduled to be installed in 4 construction campaigns from 2024 through 2027, with the first phase of the Project commissioned and operational by the end of 2025. Since decommissioning will be completed after the 25-year operational phase, a separate Part 55 OCS air permit application will be submitted for decommissioning prior to the conclusion of the operational period.

This Air Quality Impact Modeling Protocol (Protocol) addresses the proposed methodology to quantify the ambient air impacts resulting from the air emissions during Project construction and O&M activities as required by the Maryland Department of the Environment (MDE) air regulations at 26 Code of Maryland Air Regulations (COMAR) 11.06.14. The Protocol considers emissions of OCS sources associated with the Project. Emissions are defined pursuant to 40 CFR Part 55 as emissions from OCS sources, which include certain vessels while attached to the seabed or to the Project, and certain vessels traveling to and from the Project when within 25 nautical miles (46.3 kilometers [km]) of the Project's center (the 25-NM [46.3 km] centroid or the OCS centroid). Construction of the Project would involve emission sources attached to and erected upon on the OCS; therefore, an air permit is required by the OCS permitting rules (40 CFR Part 55).

US Wind intends to submit an application for a Nonattainment New Source Review (NNSR) and Prevention of Significant Deterioration (PSD) major source air permit from the MDE for the construction and O&M of the Project. US Wind submits the Protocol to MDE as a step toward completing the application. The Protocol specifically addresses the construction and O&M phases of the Project and defines the sources to be modeled, provides preliminary emissions estimates (final estimates will be provided in the OCS air permit application), and describes the modeling methodologies that US Wind proposes for the Project's air quality impact assessments. Once MDE approves the Protocol, US Wind will use the approved methodology to complete the air quality impact modeling for the Project.

The Project is subject to both federal and state air quality regulations. Worcester County, Maryland is the nearest onshore area (NOA) for the Project, and as it is expected that the NOA will also be the designated corresponding onshore area (COA) per 40 CFR § 55.5, the Project will be subject to the applicable requirements of Title 26 of the COMAR Subtitle 11, which have been incorporated into 40 CFR Part 55 by reference and have been listed in Appendix A of the OCS Air Regulations. While the Project is subject to the federal OCS regulations as administered by MDE through an authorization by the United States Environmental Protection Agency (USEPA), most of the Project is located within 25 NM of the NOA's seaward boundary, therefore the COA's applicable air quality rules must be addressed in addition to the federal rules that apply throughout the OCS. Figure 1 depicts the distances from the centroid of the Project area to several nearby onshore locations to illustrate and support the proposed designation of Maryland as the COA.

The COA for the proposed Project is located in a USEPA-designated attainment area for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM) with an aerodynamic diameter less than 10 micrometers (μm) (PM-10), particulate matter with an aerodynamic diameter less than 2.5 μm (PM-2.5), and ozone. Because the COA will be located in an area designated as the ozone transport region, the applicability of the NNSR requirements of 26 COMAR 11.17 must also be considered. In this case, the requirements of NNSR apply to new major stationary sources that are major for emissions of ozone precursor pollutants (NO_x and VOC). Pursuant to 26 COMAR 11.17.01.B(17)(a)(ii), any stationary source of air pollution located in Worcester County which emits or has the potential to emit 50 tpy of VOC or 100 tpy of NOx is a major stationary source.

Preconstruction air permitting programs that regulate the construction of new stationary sources of air pollution are commonly referred to as new source review (NSR). Major NSR requirements comprised of PSD and NNSR regulations are established on a federal level but may be implemented by state or local permitting authorities under either a delegation agreement with USEPA or as a SIP program approved by USEPA. MDE adopted the federal PSD permitting program in 26 COMAR 11.06.14 and the federal NNSR permitting program in 26 COMAR 11.17. The Project is not classified as one of the 28 named source categories listed in Section 169 of the Clean Air Act. Therefore, to be considered a "major stationary source" subject to PSD, the facility would need to have potential emissions of 250 tons per year or more of any regulated pollutant (100,000 tons per year for carbon dioxide equivalents (CO2e)).

For projects subject to 40 CFR Part 55, construction emissions apply to the determination of whether the project is subject to the PSD and NNSR permitting process. Potential emissions during Project construction will exceed the 250 tpy PSD major source review threshold and the 100 tpy NNSR threshold for nitrogen oxide (NOx) emissions. Therefore, the Project will be classified as both a PSD and an NNSR major stationary source. A detailed PSD/NNSR applicability assessment will be provided in the OCS air permit application for the Project.

US Wind expects that emissions of one or more criteria air pollutants would exceed the pollutant specific PSD/NNSR significant emission rates (SER) and, consequently, an air dispersion modeling analysis will be required for these pollutants. Furthermore, an air quality assessment to determine the potential impact of the project emissions on the National Ambient Air Quality Standards (NAAQS) will be required. The air quality analysis will be required to demonstrate that the Project will be compliant with all applicable PSD increment levels and NAAQS.

The Protocol describes the air quality modeling analysis methodologies to be used and the air quality impact assessments to be performed as part of the USEPA OCS air permit application process. The proposed modeling procedures are intended to be consistent with guidance provided by USEPA in the "Guideline on Air Quality Models" in Appendix W of 40 CFR Part 51.

Figure 1-1: Distances to Corresponding Onshore Area

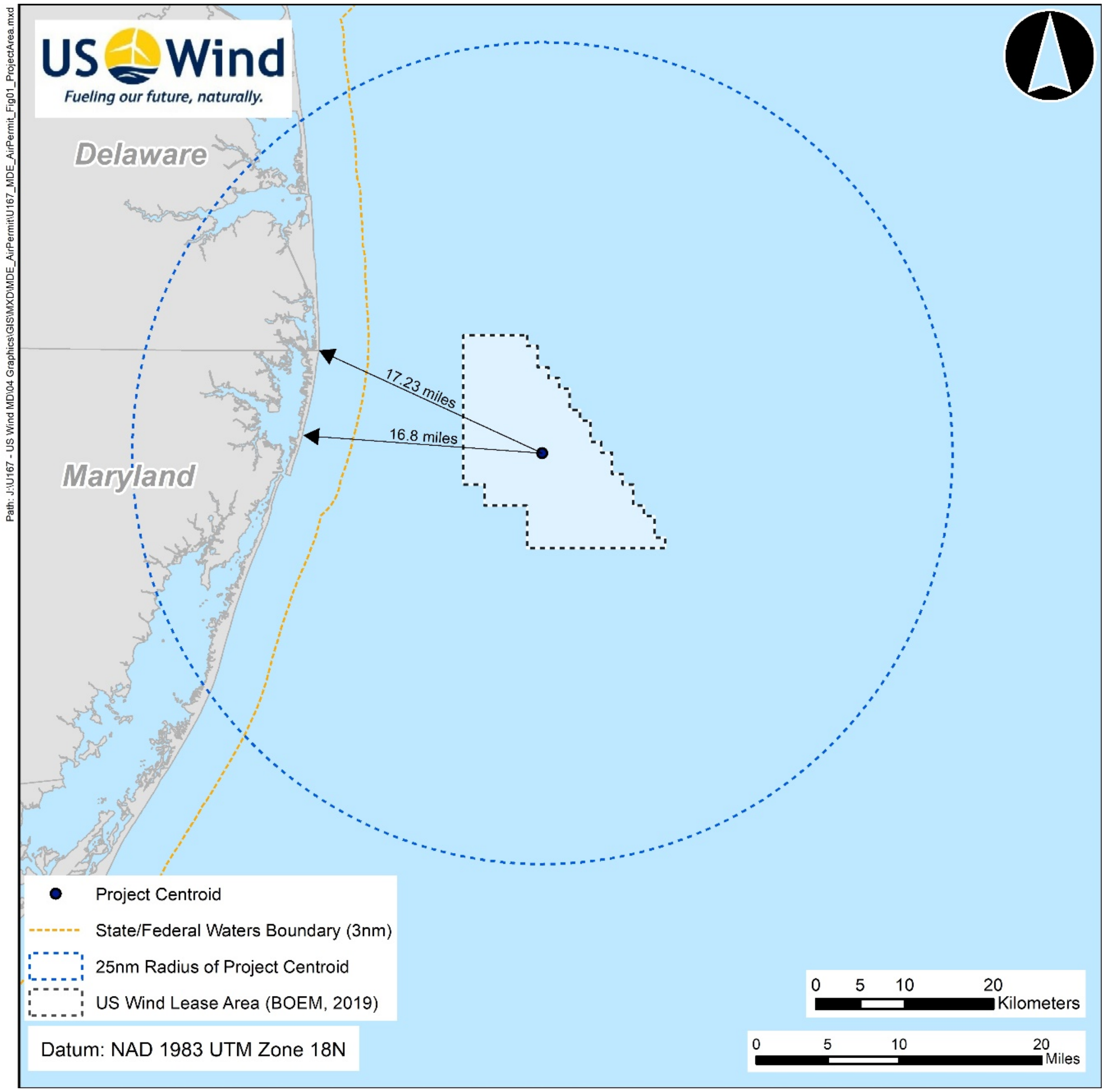
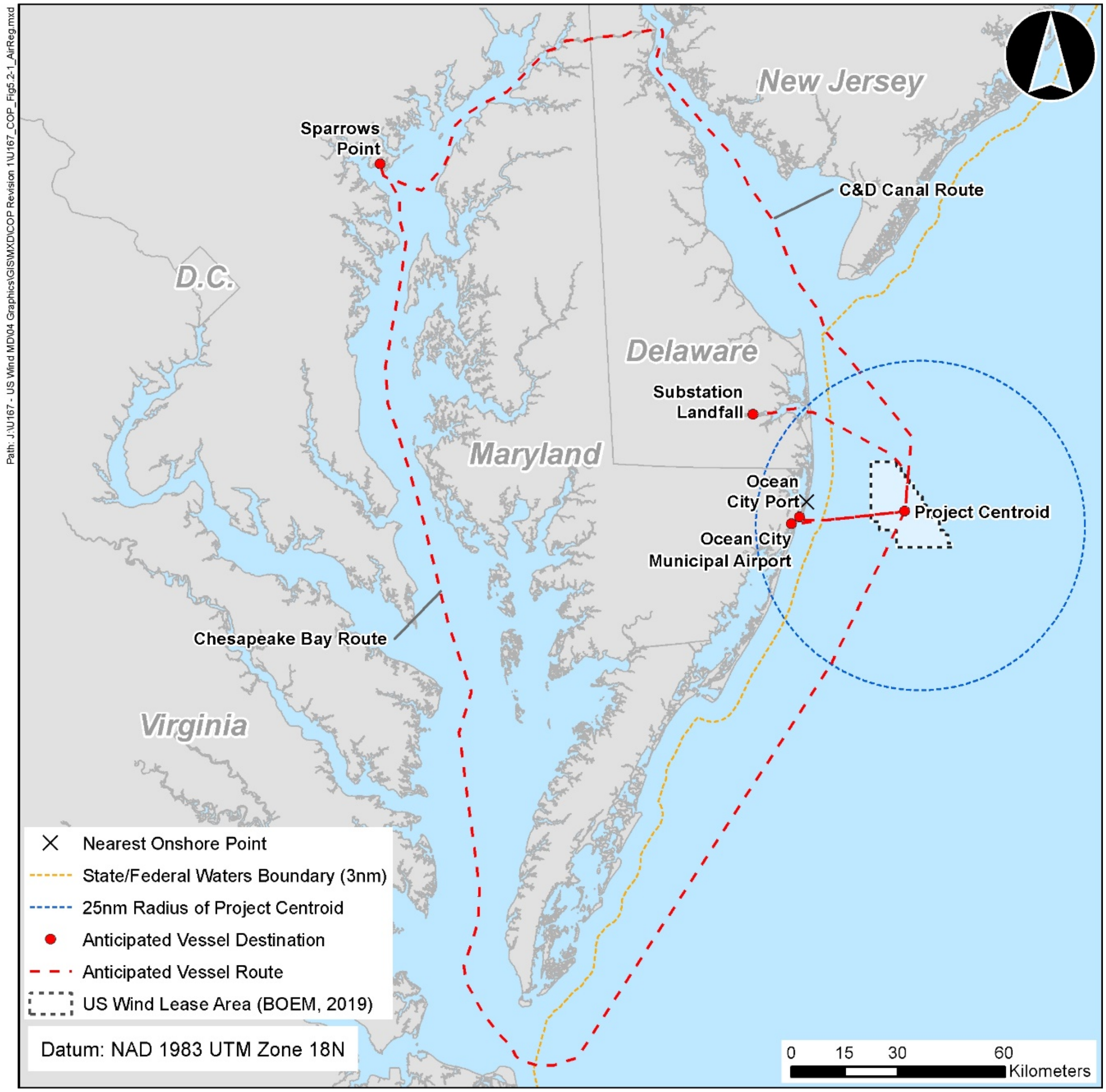


Figure 1-2: Project Location of Maryland Offshore Wind Project



2.0 PROJECT DESCRIPTION AND EMISSIONS

The pollutant-emitting activities within the wind development area (WDA) are part of a single plan to construct and operate the Project. For Part 55 OCS air permits, the definition of the WDA[1] comprises the WTGs and their foundations, the OSSs and their foundations, and the inter-array cables. In addition to the windfarm components in the WDA, the facility would include vessels when they meet the definition of an OCS source in Part 55 (i.e., when permanently or temporarily attached to the seabed for the purpose of exploring, developing, or producing resources; or physically attached to an OCS facility).

During construction, pollutant-emitting activities from the windfarm include temporary diesel generators (i.e., engines) used to supply power to the WTGs and OSSs during commissioning, temporary diesel generators associated with powering noise attenuation technologies, and engines on vessels that meet the definition of OCS source. During the O&M phase, pollutant-emitting activities from the windfarm would include engines on vessels that meet the definition of an OCS source, as well as generators on the OSSs.

As required by Section 328 of the Clean Air Act, when a vessel does not meet the definition of an OCS source, the emissions from vessels servicing or associated with any part of an OCS source are included in the potential emissions from the OCS source when the vessel is within 25 nautical miles of the centroid of the source (OCS Area), including while traveling to and from any part of the OCS facility. Emissions from vessels that would support Project construction and O&M when within 25 NM of the centroid are included in the potential emissions of the OCS facility. The Project construction and O&M activities are summarized below and will be detailed in the OCS air permit application.

The construction of the Project is proposed for up to 4 campaigns. Each construction campaign would follow this general sequence:

- Installation of the OSS;
- Offshore export cable installation;
- WTG monopile foundation installation;
- Inter-array cable installation;
- WTG installation; and
- WTG commissioning.

1 The WDA is equivalent to the Lease area shown in Figure 1-1 and 1-2

The types of emissions activities included in the construction and O&M phases are described as follows.

Construction emissions would consist of the following activities:

- Vessel transit within the OCS area (i.e., 25 NM from the centroid as shown on Figure 1-1);
- On-vessel equipment usage including diesel generators;
- Onsite maneuvering at the WTGs and at the OSSs;
- Export and inter-array cable laying within the OCS area; and
- Commissioning activities (e.g., temporary diesel generators).

O&M emissions would consist of the following activities:

- Vessel transit within the OCS area;
- Onsite maneuvering at the WTGs and OSSs; and
- Onsite emergency generators.

Air emissions associated with the construction and O&M phases of the Project depend on many factors, such as location, scope, type, capacity of equipment, and schedule. Potential emissions would be generated by emission sources associated with the Project, such as engine exhaust from marine vessels and heavy equipment/engines used during construction. Decommissioning of the Project would be completed after the 25-year operational phase, therefore a separate OCS air permit application would be submitted for decommissioning at a later date prior to the conclusion of the O&M phase.

Air pollutants emitted during the Project's construction and O&M phases would include: NOx, VOC, CO, PM_{10}, $PM_{2.5}$, greenhouse gas emissions as carbon dioxide equivalents (CO_2e), SO_2, and total hazardous air pollutants (HAPs, individual compounds are either VOC or particulate matter). The potential emissions have been estimated separately for the construction phase and the O&M phase.

For a vessel to be considered an OCS source, it must be permanently or temporarily attached to the seabed and also erected on the seabed for the purposes of exploring, developing, or producing resources. See Section 2.1 for discussion of vessels as an OCS source.

During the Project's O&M phase, emissions would be far less than during construction. The operation of the WTGs would not generate air emissions and only the OSSs would meet the definition of an OCS source as they would be attached to the OCS and would have emissions from diesel electric generators. The generators located on the OSSs would complete weekly and annual testing during the Project's O&M phase. O&M activities would also likely consist of small vessels transiting to and from the Project to service the WTGs or the OSSs over the 25-year operational life. Crew transport vessels and service operations vessels would transport crew and equipment to the offshore Project area for inspections, routine maintenance, and repairs.

Construction vessels would transit between onshore support/staging facilities at potential ports located in Maryland, Virginia, or New Jersey and the Project work area. It is anticipated that the large construction vessels would be staged at Sparrows Point in Baltimore, Maryland, while support vessels for crew transfer would stage from Ocean City, Maryland during both the construction and O&M phases. Most of these vessels and onboard construction equipment would utilize diesel engines burning low sulfur fuel, while some larger construction vessels may use bunker fuel.

A summary of the *preliminary* potential annual OCS air emission estimates[2] is presented in Table 2-1 for construction phase and O&M phase activities. The preliminary potential emissions during construction include vessel transit within the OCS Area for WTG and OSS installation, including on vessel equipment usage and propulsion engine usage. Construction emissions also include vessel emissions within the OCS for export and inter-array cable laying activities. Preliminary potential emissions presented during operation include potential emissions from the OSS diesel generators and potential emissions from vessels used to transport crew and equipment while on-site at the OSSs and WTGs or enroute to and from the OSSs and WTGs, and for routine maintenance and infrequent repairs.

The Project would be constructed in up to four campaigns over [4] years, therefore some portions of the wind farm would be under construction while other parts would be operational. Annual construction emissions reflect these overlapping periods by including O&M emissions for WTGs that have been commissioned and are operational while the remainder of the WTGs and OSSs are constructed and commissioned.

The *preliminary* estimate of the Project's potential air emissions was conducted assuming that all WTG positions, all OSSs, and the maximum length of inter-array, and offshore export cables would be installed, which represents the maximum design scenario[3]. The emissions rates provided in Table 2-1 are conservative as they are based on Bureau of Ocean Energy Management (BOEM) Tool default emission factors and operational assumptions. For

2 Based on *Notice of Intent to Submit an Application for an Outer Continental Shelf Air Permit Maryland Offshore Wind Project – US Wind, Inc* (August 5, 2022).

3 Equivalent to the Project Design Envelope as presented in US Wind's Construction and Operations Plan submitted to the Bureau of Ocean Energy Management.

example, the vessels main and auxiliary engines are assumed to operate 24 hours a day within 25 nautical miles of the Project, which is not how the vessels would operate during the construction campaigns. Additionally, these emission estimates do not take into consideration a regulatory control technology assessment (i.e., a Best Available Control Technology (BACT) assessment) that would be required to be included within the OCS air permit application. The emission estimates will be updated in the OCS air permit application to reflect refinements in the Project design and construction plan and to reflect more refined emission factors based on the results of the regulatory control technology assessments for vessel and auxiliary engine operations.

2.1 Vessels

Most of the air emissions from the Project would come from the main and auxiliary engines of the various construction equipment and vessels. For a vessel to be considered an OCS source, it must be permanently or temporarily attached to the seabed and also erected on the seabed for the purposes of exploring, developing, or producing resources.

In accordance with the Environmental Appeals Board (EAB) decision in re Shell Gulf of Mexico, Inc. and in re Shell Offshore, Inc., 15 EAD 193 (220)[4], the potential emissions of an OCS source must also include emissions from associated support vessels when they are within 25 nautical miles of the OCS source, but only during the time it is considered an OCS source (i.e., attached to the seabed).

Anchor-pulling vessels associated with offshore export cable installation (on waters above the OCS) are temporarily attached to the seabed, however, the vessels are not erected on the seabed because they do not remain stationary at the location of the OCS activity. Additionally, anchor-pulling vessels and their activities are not considered "exploring for, developing, or producing resources" as defined in the Outer Continental Shelf Lands Act (OCSLA), as these terms are defined in the context of platform construction and anchor-pulling vessels associated with the offshore export cable installation are not used for platform construction. The USEPA determined that, although pull-ahead anchor vessels are attached to the seabed, this equipment does not meet the other two criteria for classifying a vessel as an OCS source and, therefore, should not be subject to the permitting requirements applicable to OCS sources[5].

In addition to the potential use of anchor-pulling vessels for export cable installation, US Wind may also use dynamic positioning system (DPS) vessels. A dynamic positioning system uses

[4] https://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/Decision~Date/4E0547DAD63F032F852578540048BEC3/$File/Shell%20Gulf%20of%20Mexico%20II.pdf

5 June 24, 2021 Fact Sheet for South Fork Wind can be accessed at https://www.epa.gov/caa-permitting/south-fork-wind-llcs-south-fork-windfarm-outer-continental-shelf-air-permit

computer-controlled thrusters to maintain position along the cable route, and the ship's forward momentum comes from its own on-board propulsion, not winches and anchors. The USEPA has determined that cable laying vessels are not OCS sources when these vessels are using a DPS (a computer-controlled system of thrusters with no anchors) to advance and maintain lateral position along the export cable route[6]. DPS vessels may not be permanently or temporarily attached to the seabed and as such, DPS vessels are not OCS sources only on that basis. Additionally, DPS vessels are neither erected thereon nor used for the purpose of exploring, developing or producing resources therefrom. As such, USEPA has determined that cable-laying vessels using either a pull-ahead anchor system or a dynamic positioning system do not meet the criteria to qualify vessels as OCS sources.

However, consistent with previous decisions, USEPA has determined that emissions from cable laying vessels should be included in the potential to emit of the OCS source when located at or traveling within 25 nautical miles of the centroid of the OCS area[7]. It is difficult to predict which support vessels will be enroute to and from a vessel while it is considered an OCS source at the Project site (for example, which vessels will be enroute while a jack-up vessel is jacked up). Therefore, for purposes of the OCS air permit, all vessels within 25 nautical miles of the centroid of the wind turbine array are conservatively included in the potential emissions of the construction phase of the Project, including those which are anticipated to be utilized prior to the first instance of an OCS source. Therefore, the OCS source includes all vessels associated with the construction phase of the Project when those vessels are on-site (within the wind turbine array area) or enroute to or from the wind turbine array area when within 25 nautical miles[8] of the centroid of the wind turbine array area.

A summary of air emission sources for WTG installation as well as cable laying and OSS construction are shown in Table 2-2. The types of vessels expected to be used for the Project are listed and were classified as consistent with the equipment types used within the BOEM emission estimating tool.

A complete description of all of the emission points associated with the Project, including engine sizes, hours of operation, load factors, emission factors, and fuel consumption rates will be provided in the OCS air permit application.

2.1.1 Emission Sources During Construction

Emissions from the Project would be generated by the main engines, auxiliary engines, and equipment on vessels used during construction activities. Emissions from marine

6 EPA Memorandum, Source Determination Analysis for Vineyard Wind OCS Windfarm (June 26, 2019)
7 June 24, 2021 Fact Sheet for South Fork Wind.
8 A unit of nautical miles is used in accordance with EPA interpretation of the Part 55 regulations.

vessel engines would also be generated while vessels maneuver within the WDA, during installation of the offshore export cables, and during vessel transit to and from port.

Construction of the Project would require the use of an array of vessels. During construction, heavy lift vessels, tugboats, barges, and jack-up vessels would be used to transport the WTG, monopiles, transition pieces, and OSS components to the WDA. Installation of the WTGs, monopiles, transition pieces, and OSSs is expected to be performed using a combination of jack-up vessels and crane vessels. It is anticipated that scour protection would be installed around the WTG and OSS foundations. Cable-laying is expected to be performed by specialized cable-laying vessels. Crew transfer vessels are expected to be used to transport personnel to and from the WDA and may be used for marine mammal observations.

Additional offshore construction-related emissions would be generated by diesel generators used to supply power to the WTGs and OSSs before cabling is in place. Offshore emissions would also be generated by air compressors used to supply compressed air to noise mitigation devices (e.g. bubble curtains) during pile-driving, and diesel engines used to power the hydraulic pile driving hammer.

Construction operations are dynamic, with construction occurring in one area of the WDA on one day, and in a different location within the Project Area the next day. Therefore, the short-term modeling (i.e., 24 hours or less) will represent several typical construction activities occurring simultaneously to represent the "worst case" construction emissions. The annual construction scenarios modeled will include all construction activity that could occur in any of the construction years and will also include any potential O&M activities or commissioning activities that could overlap with the construction of Project components.

2.1.2 Emission Sources During Routine Operations and Maintenance

During the Project’s up to 25-year operational period, the WTGs would not generate air emissions. Rather, electricity generated by the WTGs would displace electricity generated by higher-polluting fossil fuel-powered plants and significantly reduce emissions from the PJM power grid over the lifespan of the Project.

Emission sources during O&M that are subject to the OCS air permit would include:

- Crew transfer vessels;
- Service operation vessels;

- Multipurpose offshore support vessels;
- Tugboats;
- Jack-up vessels; and
- Stand-by generators.

During the O&M phase, US Wind's offshore facilities will be routinely inspected. In addition, proactive replacement of parts and other preventative maintenance will be conducted. A more detailed description of offshore operations and maintenance activities will be provided in the Part 55 OCS air permit application.

For routine O&M, there are two primary O&M activities. Crew transfer vessels would frequently transport crew to the WDA for inspections, routine maintenance, and minor repairs. A service operation vessel, which provides accommodations and workspace, if used, may remain at the WDA for several weeks at a time. Workers would access the WTGs and OSSs to perform routine O&M via a gangway directly from the service operation vessel or a small crew transfer vessel.

Other larger support vessels, such as jack-up vessels, may be used infrequently for some O&M activities. When these vessels are within 25 nautical miles of the WTGs or OSSs, their air emissions are included in the Project's potential emissions.

Similar to the activities during construction, O&M activities will be dynamic. Therefore, the modeling will be conducted with the anticipated operational activities occurring simultaneously to represent the "worst case" O&M phase emissions.

2.2 ModelingMethodology

2.2.1 Construction Activities

A number of vessels would be required to support activities carried out during the construction and O&M phases of the Project. Specific vessels are required for surveying activities, foundation installation, OSS installation, cable installation, WTG installation, and support activities.

The vessels would vary in size and complexity based on their function on the Project. The vessels employed on the Project will be required to comply with applicable USCG and Jones Act regulations for conducting operations in U.S. waters. All foreign flag vessels employed on the Project will, in addition to meeting applicable USCG and Jones Act requirements, be required to meet International Maritime Organization (IMO) and International Marine

Contractors Association (IMCA) requirements. The specific vessels selected to perform the required tasks during construction will be dependent upon availability at the commencement of each activity. US Wind will secure vessel supply in advance to prevent any delays to the construction schedule.

Because construction activity is expected to occur over a 4 year period, and numerous individual vessel activities will occur over this time period, the short-term (i.e., 1-hour, 3-hour, 8-hour, and 24-hour) and annual construction activities that result in maximum air emissions are proposed to be modeled for comparison to NAAQS and PSD increments. With this modeling methodology, any combination of construction activities that would result in lower emissions would have less of an air quality impact than from the maximum emissions scenarios.

The proposed peak month and peak year of construction will capture all of the activities that could potentially occur within the 25 NM OCS area and as such, are proposed to be included for the 1-hour, 3-hour, 8-hour, 24-hour, and annual modeling analyses. For the peak month and year of construction, the following activities may be taking place in various areas of the WDA simultaneously:

- Monopile (MP) Foundation Installation;
- Scour protection installation;
- WTG Installation;
- WTG Commissioning;
- OSS Installation;
- OSS Commissioning;
- Inter-Array Cable Installation; and
- Offshore Export Cable Installation.

Activities would occur throughout the 25 NM OCS area and will be transient. For example, the monopile foundation installation would occur over the course of two days for a specific WTG location. Then, the group of ships responsible for the monopile installation would move to the next WTG position and begin installation of another monopile. For simplification of the modeling given this spatial and temporal uncertainty regarding vessel locations, the modeling will be conducted based on the assumption that these activities occur at the same location for the entire modeled period. However, should this conservative assumption result in overly conservative modeling results, each WTG and OSS location will be modeled individually based on the maximum number of WTGs and OSSs that can be constructed within the short-term or annual periods. It is anticipated that the individual WTG and OSS locations will be modeled for the annual averaging period given the conservative nature of modeling all annual vessel activity at the same location.

2.2.2 O&M Activities

O&M phase emissions would consist of the following activities:

- Vessel transit within the OCS area;
- Onsite maneuvering at the WTGs and OSSs; and
- Onsite diesel generators.

During the Project's O&M phase, emissions would be far less than during construction. The operation of the WTGs would not generate air emissions. The only "permanent and stationary" source of potential emissions are diesel electric generators that would be installed on the OSSs. The OSSs meet the definition of an OCS source as they would be attached to the OCS and would have emissions from those diesel electric generators.

Similar to construction activities, the O&M activities will occur throughout the 25 NM OCS area and will be transient. For simplification of the modeling given this spatial and temporal uncertainty regarding vessel locations, the modeling will be based on the assumption that O&M activities occur at the same location for the entire modeled period. However, should this conservative assumption result in overly conservative modeling results, each WTG and OSS location will be modeled individually based on the maximum number of WTGs and OSSs that can be serviced within the short-term or annual periods.

2.3 Exhaust Stack Configuration and Emission Parameters

US Wind has provided estimates of source parameters (exit velocity, stack diameter, stack exit temperature) in Appendix A for the types of ships that may be used for the construction and O&M activities. Appendix A also lists the individual vessel and equipment types associated with each of the activity types that are proposed to be modeled. This general modeling conservatism is consistent with the PDE concept and allows for a demonstration of compliance with the applicable NAAQS standards and PSD Increments. Final construction, operation, and maintenance methods may differ as the Project is optimized.

2.3.1 Source Characterization

US Wind proposes to use the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm, as implemented within the AERCOARE program for use in the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). The AERCOARE-AERMOD modeling system is an alternative for assessing compliance with air quality standards when emission sources and dispersion occur over water. Prognostic data from the Weather Research and Forecast (WRF) Model is used to derive the hourly surface data and upper air data (i.e., humidity, temperature, and water surface temperature) that is used for meteorological observations.

As described in Appendix W to 40 CFR Parts 51 and 52, the AERMOD model is a steady state Gaussian model. The AERMOD model was designed for assessing pollutant concentrations from a wide variety of sources (point, area, and volume). AERMOD is currently recommended for modeling studies in rural or urban areas, flat or complex terrain, and transport distances less than 50 kilometers, with one hour to annual averaging times.

The vessel emissions will be assumed to be released from two types of modeled sources:

1) A point source; which includes emissions from on-vessel equipment used for onsite maneuvering and cable installation, and stationary diesel engines for the following activities:

- Monopile (MP) foundation installation;
- Scour protection installation;
- WTG installation;
- WTG commissioning;
- OSS installation;
- OSS commissioning;
- Inter-array cable installation; and,
- Offshore export cable installation.

2) Line sources, which include emissions from transit sources and the export cable installation emissions:

- WTG installation supply trips (transit);
- Inter-array cable vessel supply trips (transit);
- Export cable vessel supply trips (transit); and,
- Offshore export cable installation.

The allocation of each of these activities to the model sources are shown in Table 2-3. Two line sources will be considered in the modeling:

1. Line 1 – Supply: Corresponds to the supply route running between the port and the WDA work area. These different model scenarios correspond to different ports being used for the supply routes. The anticipated ports for each of the supply vessels are identified in Appendix A.

2. Line 2 – Export Cable Installation: The export cable-laying route running between the OSS at the WDA and the interconnection facility in Delaware.

2.3.2 Line 1 – Supply

The AERMOD model allows for modeling multiple line source at a time, and the averaging period may be 1-hour to annual. Therefore, the line sources will be modeled as a set of individual point sources along the length of the line. The total aggregate emissions of the individual point sources will be the same as the total line source emissions calculated for the vessel activity. The point sources representing the line source will be spaced approximately 0.6 mile (1 km) apart. This representation of the line sources will allow for consistent modeling of 1-hour, 3-hour, 8-hour, 24-hour, and annual averages.

The point sources proposed to be used as proxies for transit and line sources will be representative of typical towing tug vessels (Line 1) or cable installation vessel (Line 2), The actual vessels used for various equipment, installation vessels, crew, and support transport are varied.

2.3.3 Line 2 – Offshore Export Cable Installation

The offshore export cable laying will be slow-moving; therefore, over a 24-hour period, the line source will be 0.6 mile (1 km) long and placed along the cable-laying route, just as it connects with the inter-array cable system near a central OSS. This line source placement will result in worst-case short-term impacts because it is near co-located with other vessels' emissions occurring at or near the WDA. For the annual averaging periods, it is expected that emissions will occur along the entire length of the offshore export cable route. For modeling the annual emissions, the source will be placed along the offshore export cable route.

2.4 Good Engineering Practice Stack Height

Section 123 of the Clean Air Act (CAA) Amendments required the USEPA to promulgate regulations to assure that the degree of emission limitation for the control of any air pollutant under an applicable State Implementation Plan (SIP) was not affected by (1) stack heights that exceed Good Engineering Practice (GEP) or (2) any other dispersion technique. The USEPA provides specific guidance for determining GEP stack height and for determining whether building downwash will occur in the Guidance for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations), (EPA-450/4-80-023R, June, 1985). GEP is defined as "…the height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, and wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles."

The GEP definition is based on the observed phenomenon of atmospheric flow in the immediate vicinity of a structure. It identifies the minimum stack height at which significant adverse aerodynamics (downwash) are avoided. The USEPA GEP stack height regulations specify that the GEP stack height be calculated in the following manner:

$$H_{GEP} = H_B + 1.5L$$

Where: H_B = the height of adjacent or nearby structures, and
L = the lesser dimension (height or projected width of the adjacent or nearby structures).

Structure downwash will be incorporated into the AERMOD model by specifying a structure height and width that are nearby a specific source and could influence dispersion from that source. The main structure for scenarios that could influence dispersion is the OSS platform. While the AERMOD model does not incorporate platform downwash using a platform downwash algorithm based on laboratory experiments, US Wind has proposed use of PRIME considering the platform as a solid structure which will result in conservative, overprediction of concentrations. The final design of the OSS has not yet been determined, but based on information provided by US Wind to BOEM in the Construction and Operations Plan (COP), the OSS topside dimensions are anticipated to range from 30 m by 43 m and 50 m high up to 40 m by 80 m and 60 m high. Therefore, a typical design value of 50 m height will be assumed. The structure dimensions and associated downwash are conservative in that it assumes a solid foundation down to sea level, instead of the OSS being several meters above sea level on the monopile foundations.

These downwash dimensions will also be assigned to the jack-up vessels and the supply barges as these vessels will likely be attached or near the OSS structure during construction and large-scale repairs during O&M and therefore be potentially influenced by its wake effects. The diesel electric generator may be located on top of the OSS platform and therefore may be subject to its influence as well. The crew transport vessels are assumed to be transiting to or from the platform such that their emissions release point is mostly independent of the platform wake, and therefore downwash effects will not be assigned to these vessels.

The solid structures on the vessels (superstructure, vessel hulls) themselves are considerably smaller than those of the OSS and therefore downwash from these on-vessel structures are anticipated to be minor compared to the influence of the OSS. Also, the exact dimensions of the various vessels to be used will likely change each visit, and therefore modeling a single vessel “layout” for downwash purposes is not appropriate.

Table 2-1: Construction and O&M Emission Estimates

Phase	NO_x	VOC	CO	PM10	PM2.5	SO_2	CO_2	CH_4	N_2O	HAP	CO2e
Total Construction Period Emissions (tons per year) (Includes O&M and Commissioning Emissions)											
Year 1	817.7	10.9	192.2	16.3	15.8	31.9	52,661.0	0.2	0.04	1.5	52,678.7
Year 2	2,097.2	28.0	493.0	41.7	40.5	81.9	135,068.7	0.5	0.1	3.9	135,114.1
Year 3	1,171.3	15.7	275.3	23.3	22.6	45.7	75,435.7	0.3	0.1	2.2	75,461.1
Year 4	486.7	6.5	114.4	9.7	9.4	19.0	31,350.1	0.1	0.02	0.9	31,360.6
Total	4,572.9	61.1	1,074.9	91	88.3	178.5	294,515.5	1.1	0.2	8.5	294,614.5
Total O&M Emissions (tons per year)											
Annual	85.9	1.1	20.2	1.7	1.7	3.3	5,530.8	0.02	0.004	0.2	5,532.7

Table 2-2: Emission Source Descriptions

Emission Source	Purpose	Phase
Heavy lift crane vessels	Lift, support, and orient the components of each WTG and OSS during installation. Used for foundation installation.	Construction
Cable installation vessels	Lay and bury transmission cables in the seafloor.	Construction
Scour protection installation vessels	Deposit a layer of stone around the WTG and OSS foundations to prevent the removal of sediment by hydrodynamic forces. May place cable protection over limited sections of the offshore cable system.	Construction
Multipurpose offshore support vessels	Clear the seabed floor of debris prior to laying transmission cables.	Construction
Tugboats	Transport equipment and barges to the OCS source.	Construction and as needed Operational
Anchor handling tug supply vessels	Install underwater noise mitigation devices (e.g., bubble curtains). Support offshore export cable installation.	Construction
Jack-up vessels	Transport WTG components to the WDA. Extend legs to the ocean floor to provide a safe, stable working platform used for offshore crew accommodation.	Construction and, as needed, Operational
Dredging vessels	Used in certain areas prior to cable laying to remove the upper portions of sand waves.	Construction
Survey vessels	Used to perform geophysical and geotechnical surveys.	Construction
Service operation vessels	Transport crew to the WDA. Provide offshore living accommodation and workspace.	Construction and, as needed, Operational
Ocean-Going Heavy Transport Vessels (HTV)	Ocean-going vessels that may transport components (e.g., monopiles) directly to the WDA.	Construction
Offshore Substation Diesel Electric Generator	An OSS serves as the common interconnection point for the WTGs. The WTGs would interconnect with an OSS via a submarine cable system. Each OSS may have a diesel electric generator.	Construction and Operational

Table 2-3: Summary of Source Allocation by Activity Type

Construction Activity	***Source Allocation/Type***
WTG installation supply trips (transit)	***Line 1 – Supply*** – Modeled as a series of points sources
Inter-array cable vessel supply trips (transit)	***Line 1 – Supply*** – Modeled as a series of point sources
On-vessel equipment	***Point*** source at centroid of OCS Area[1]
Onsite maneuvering	***Point*** source at centroid of OCS Area[1]
Inter-array cable installation	***Point*** source at centroid of OCS Area[1]
Export Cable installation	***Line 2*** – Modeled as a series of point sources
Export Cable vessel supply trips (transit)	***Line 1 – Supply*** – Modeled as a series of point sources

Notes:

1. The location of WTGs and OSSs that will be constructed will vary over the course of any given averaging period and over the course of the construction period. The initial modeling will conservatively assume that all WTG and OSS construction activities occur at a single WTG or OSS. However, if this proves to be too conservative of an assumption, individual WTG and OSS locations will be modeled.

3.0 REGULATORY REQUIREMENTS

Section 328(a) of the Clean Air Act requires that USEPA establish air pollution control requirements for OCS sources located within 25 nautical miles of states' seaward boundaries that are the same as onshore requirements. This includes, but is not limited to, state and local requirements for emission controls, emission limitations, emission offsets, permitting, monitoring, testing, and reporting. The purpose of this requirement is to attain and maintain Federal and State ambient air quality standards. USEPA's OCS implementing regulations, found at 40 CFR Part 55, apply to all OCS sources offshore of the states except those located in certain areas of the Gulf of Mexico.

OCS sources located within 25 NM of a States' seaward boundaries are subject to the Federal requirements set forth in 40 CFR § 55.13 and the Federal, State, and local requirements of the COA set forth in 40 CFR § 55.14. Because the Project's WDA is located on the OCS within 25 NM of Maryland's seaward boundary, the Project will be subject to the applicable requirements of the most current Maryland Air Regulations that are listed in Appendix A of the OCS Air Regulations. Notable federal, state, and local requirements of the COA incorporated by reference into 40 CFR § 55.13 and 55.14 that pertain to the air modeling protocol include New Source Performance Standards (NSPS), Prevention of Significant Deterioration (PSD) review, and Nonattainment New Source Review (NSR). All applicable requirements that include air quality impact assessments are outlined in this section.

3.1 New Source Review

The NSR program consists of the NNSR and PSD programs. Applicability of these programs to the proposed Project is determined based upon the attainment status of the COA and the Project's potential emissions. Maryland's NNSR requires the use of lowest achievable emission rate (LAER) controls and compliance with emission offset requirements should facility emissions exceed applicable thresholds. PSD requires the application of best available control technology (BACT) on a pollutant-by-pollutant basis should facility emissions exceed applicable thresholds. An emissions analysis will be provided in the Part 55 OCS Air Permit Application to demonstrate applicability, by pollutant, of the PSD/NNSR requirements to the Project.

3.2 Attainment Status

The USEPA has established NAAQS for each of the following criteria air pollutants: PM-10, PM-2.5, SO_2, ozone (O_3), NO_2, CO, and lead (Pb). Areas in which the NAAQS are being met are referred to as attainment areas. Areas in which the NAAQS are not being met are referred to as non-attainment areas. Areas that were formerly non-attainment areas but are now in attainment and covered by a maintenance plan are referred to as maintenance areas. Areas for which sufficient data are not available to determine a classification are referred to as unclassifiable. The federal attainment status designations of areas in Maryland with respect to NAAQS are listed at 40 CFR § 81.321. Worcester County is in Eastern Shore Intrastate Air Quality Control Region (AQCR) 114.

The COA is in an area currently designated as attainment for SO_2, NO_2, CO, PM-10, PM-2.5, and ozone. Worcester County, however, is located in the ozone transport region, and under this designation for 8-hour ozone, new facilities with emission increases more than 100 tons per year of NO_x and/or more than 50 tons per year of VOC, respectively, are subject to NNSR for these pollutants and require the application of LAER controls and emission offset requirements.

3.2.1 Prevention of Significant Deterioration (PSD)

The PSD Program, as set forth in 40 CFR § 52.21 is incorporated by reference into the OCS Air Regulations 40 CFR 55.13(d). PSD applies to OCS sources located within 25 NM of a State's seaward boundary if the PSD requirements are in effect in the corresponding onshore area. Per 40 CFR Part 52, Subpart W, the PSD program is in effect in Maryland.

The PSD program applies to new major sources of criteria pollutants or major modifications to existing sources in areas designated as being in attainment with or unclassifiable with the ambient air quality standards. Certain categories of stationary sources listed in 40 CFR 55.21(b)(1)(i)(a) are considered "major" if the source emits or has the potential to emit (PTE) 100 tons per year or more of a "NSR regulated pollutant as" defined in 40 CFR § 52.21(b)(50). All other stationary sources are considered "major" if it emits or has a PTE of 250 tpy or more of a regulated NSR pollutant. Since the Project does not fall under any of the stationary source categories listed under 40 CFR 55.21(b)(1)(i)(a), the 250 tpy of NSR pollutant threshold applies.

"Potential to emit" is defined as the maximum capacity of a source to emit a pollutant under its physical and operational design (see 40 CFR § 52.21(b)(4)). As noted, 40 CFR Part 55 defines "potential emissions" from OCS sources similarly. Typically, emissions from mobile sources and secondary emissions do not count when determining a stationary source's potential to emit for the purposes of PSD review. Secondary emissions are defined as emissions resulting from the construction or operation of a major stationary source that do not come directly from the major stationary source as (40 CFR 52.21(b)(18)). However, the broad definition of "OCS source" provided in the OCS Air Regulations requires certain construction equipment and vessels to be included in the “potential to emit” of an OCS source for PSD review.

The Project’s potential air emissions during construction exceed the 250 tpy PSD threshold. Consequently, the Project is subject to PSD review. Thus, PSD regulations apply to each criteria pollutant that is emitted in excess of a defined Significant Emission Rate. Further, if GHG emissions expressed as carbon dioxide (“CO2”) equivalent (or “CO2e”) are greater than 75,000 tpy for a project that is a new major stationary source for a regulated NSR pollutant that is not GHGs, then GHGs are also included as a PSD pollutant. Table 3-1 presents a preliminary PSD major source threshold analysis for the Project for those pollutants with applicable PSD emission criteria.

Facilities subject to PSD must perform an air quality analysis (which includes atmospheric dispersion modeling) and a BACT demonstration for those pollutants that exceed the pollutant specific Significant Project Thresholds identified in the regulations. The PSD SERs and NNSR thresholds are provided in Table 3-2. (Note that since NO_x and VOC are precursors to ozone formation, NO_x and VOC emissions will be controlled to the more stringent LAER emission levels if they exceed the NNSR thresholds).

Dispersion modeling for the PSD requirements consists of three analyses: a significance analysis, a NAAQS analysis, and a PSD increment analysis. The significance analysis compares the maximum-modeled ambient concentrations from the proposed facility to the significant impact levels (SILs) listed in Table 3-3 for each pollutant. If the modeled concentrations for the proposed facility are less than the SILs, then more detailed NAAQS and PSD increment analyses are not required under PSD regulations. However, if the modeled concentrations are greater than the SILs, then NAAQS and PSD increment analyses are required for that pollutant. The NAAQS and PSD increments are listed in Table 3-4.

In order to facilitate this analysis, USEPA historically has relied upon SILs that represent thresholds of insignificant, i.e., de minimis, modeled source impacts. The SILs are intended to be small fractions of the NAAQS and PSD increment. USEPA has recommended specific SILs for comparison to the NAAQS and a separate set of recommended SILs for comparison to the PSD Increments. The PSD increment SILs are different for Class I, II and III areas.

As the Project triggers NNSR for Ozone, the Project triggers a requirement for NOx offsets, therefore no modeling is required for ozone. There are no Class I PSD Increment SILs for CO or GHG's, or for 1-hour NO_2.

Exceeding the PSD Increment SIL would require the Project to perform a cumulative source analysis which would account for any sources that have consumed the PSD increment within the significant impact area.

3.2.2 Preconstruction Ambient Air Quality Monitoring Exemption

As discussed previously, the PSD regulations require an applicant to perform an air quality analysis for those criteria pollutants emitted in quantities exceeding the SERs (and for which there are NAAQS) shown in Table 3-2. This analysis can include the collection of up to one year of ambient air quality monitoring data.

Pursuant to the PSD regulations, MDE may exempt a proposed PSD source, otherwise subject to the one-year pre-construction ambient monitoring requirement, if existing quality assured ambient air quality data are available from alternate locations that are representative of, or conservative, as compared to conditions at the proposed facility location.

A preconstruction monitoring exemption request will be provided to the MDE for its review and approval since US Wind is proposing to utilize existing quality assured ambient air quality data from locations that are representative of conditions at the proposed Project site.

3.2.3 Impacts on Class I Areas

There is one (1) Class I area within 300 km of the Project: the Brigantine Wilderness area located in the Edwin B. Forsythe National Wildlife Refuge (NWR) in New Jersey, approximately 136 kilometers northeast of the Project. The Federal Land Manager (FLM) for this Class I area will be notified by letter and requested to determine if assessments of impacts in the Class I areas will be required. Copies of both the letter and the FLM's response will be included in the agency correspondence appendices of the Part 55 OCS Air Permit Application.

3.2.4 Maryland Modeling Evaluations and Requirements

Under the OCS Air Regulations, OCS sources are subject to the federal, state, and local requirements of the COA set forth in 40 C.F.R. Part 55.14. In the Project's Notice of Intent (NOI), US Wind identified Maryland as the NOA to the Project Area. The Maryland regulations have been incorporated into 40 C.F.R. Part 55 by reference and are listed in Appendix A of the OCS Air Regulations.

In addition to the federal NAAQS, Maryland has promulgated state-specific ambient air quality standards (SAAQS) in 26 COMAR 11.4. The only SAAQS that exists in addition to the

NAAQS is for Fluorides. Emissions of fluorides from the Project are not expected and, as such, a SAAQS demonstrations is not required.

The air toxics emissions from the Project will be from fuel burning equipment, which are exempt from state toxics modeling requirements, as codified in 26 COMAR 11.15.03. A full assessment of air toxics requirements will be included in the Part 55 OCS Air Permit Application. If any pollutants exceed their modeling thresholds, the modeling analysis will be conducted in accordance with the PSD/NNSR modeling procedures identified in this protocol for a Class II NAAQS assessment.

Table 3-1: Prevention of Significant Deterioration Regulatory Threshold Evaluation

Pollutant	Facility Annual Emissions	PSD Significant Emission Rate	PSD Review Required
NO_x	2,097	40	Yes
VOC	28	40	No
CO	493	100	Yes
SO_2	82	40	Yes
PM10	42	15	Yes
PM2.5	41	10	Yes
Lead	0.005	0.6	No
GHGs (as CO2e)	135,114	75,000	Yes
Sulfuric Acid Mist	None expected	7	No
Hydrogen Sulfide	None expected	10	No
Total reduced sulfur	None expected	10	No
Reduced sulfur compounds	None expected	10	No

Table 3-2: PSD Significant Emission Rate Thresholds and Non-attainment NSR Major Source Thresholds

Pollutant	PSD Significant Emission Rate Thresholds (tons per year)	NNSR Major Thresholds (tons per year)
Carbon Monoxide	100	NA
Sulfur Dioxide	40	NA
Particulate Matter (PM)	25	NA
Particulate Matter less than 10 microns (PM-10)	15	NA
Particulate Matter less than 2.5 microns (PM-2.5)	10	NA
Nitrogen Oxides	40	100[a]
Ozone (VOC)	40	50[a]
Greenhouse Gases (GHG)	75,000	NA
Lead	0.6	NA
Fluorides	3	NA
Sulfuric Acid Mist	7	NA
Hydrogen Sulfide	10	NA
Total Reduced Sulfur (including H_2S)	10	NA
Reduced Sulfur Compounds (including H_2S)	10	NA

Note:

[a]As precursors to ozone – ozone transport region threshold.

Table 3-3: PSD Significant Impact Levels

Pollutant	Averaging Period	Recommended Significant Impact Levels for NAAQS Analyses (µg/m³)	PSD SIL Increments (µg/m3	
			Class I	Class II
CO	1-Hour	2,000[1]	None	2,000[1]
	8-Hour	500[1]	None	500[1]
Pb	Rolling 3-Month	None	None	None
NO2	1-Hour	7.5[2]	None	None
	Annual	1	0.1[1]	1[1]
O3	8-Hour	1.96[3]	None	None
PM2.5	24-Hour	1.2[4]	0.27[4]	1.2[4]
	Annual	0.2[5]	0.05[5]	0.2[5]
PM10	24-Hour	5[1]	0.3[1]	5[1]
	Annual	1[1]	0.2[1]	1[1]
SO2	1-Hour	7.8[2]	None	None
	3-Hour	25[1]	1[1]	25[1]
	24-Hour	5[1]	0.2[1]	5[1]
	Annual	1[1]	0.1[1]	1[1]

[1] Concentration not to be exceeded

[2] Highest 1-hour Modeled concentration averaged over 5 years

[3] Annual 4th Highest Daily Maximum 8-hour Concentration Averaged Over 5 years.

[4] Highest 24-hour modeled concentration averaged over 5 years

[5] Highest annual modeled concentration averaged over 5 years.

Table 3-4: National Ambient Air Quality Standards, PSD Increments, and Significant Monitoring Concentrations

Pollutant	Averaging Period	NAAQS[a] (μg/m³)	Class II PSD Increment (μg/m³)	Significant Monitoring Concentrations (μg/m³)
Carbon Monoxide (CO)	1-Hour 8-Hour	40,000 10,000	-- --	-- 575
Nitrogen Dioxide (NO_2)	1-Hour Annual	188 100	-- 25	-- 14
Ozone (VOC)	8-Hour	137	--	--
Coarse Particulate Matter (PM-10)	24-Hour Annual	150 --	30 17	10 --
Fine Particulate Matter (PM-2.5)	24-Hour Annual	35 12	9 4	-- --
Sulfur Dioxide (SO_2)	1-Hour 24-Hour Annual 3-Hour	196 365 80 1,300	-- 91 20 512	-- 13 -- --
Lead (Pb)	3-Month	0.15	--	0.1

Note: (--) indicates there are no standards for this pollutant.

[a]All short-term (1-hr, 3-hr, 8-hr, and 24-hr) standards except ozone, PM-2.5, PM-10, and 1-hour SO_2 and NO_2 are not to be exceeded more than once per year. For 8-hr ozone, USEPA uses the average of the annual 4th highest 8-hour daily maximum concentrations from each of the last three years of air quality monitoring data to determine a violation of the standard. For 24-hour PM-10, USEPA uses the 6th highest 24-hour maximum concentration from the last three years of air quality monitoring data to determine a violation of the standards. For 24-hour PM-2.5, USEPA uses the 98th percentile 24-hour maximum concentration from the last three years of air quality monitoring data to determine a violation of the standard. For the 1-hour NO_2 NAAQS, compliance would be determined by the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area and for the 1-hour SO_2 NAAQS, compliance would be determined with the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area.

4.0 MODELING METHODOLOGY

Impacts of criteria pollutant emissions from the Project will be modeled for comparison to the NAAQS and PSD increments. The guidance of the USEPA Guideline on Air Quality Models (40 CFR Part 52, Appendix W) will be used as well as State guidance where applicable.

In the New Source Review (NSR) Workshop Manual (EPA, 1990) the dispersion modeling analysis is separated into two distinct phases: 1) the preliminary analysis, and 2) a full impact analysis. In the preliminary analysis, the projected emissions from the project are modeled to determine the criteria pollutants which need a full impact analysis. Those pollutants for which the modeled maximum impact are below the SILs would not require a full impact analysis.

4.1 Model Selection

The USEPA guideline model for the modeling of the Project is the Offshore and Coastal Dispersion Model (OCD) (v5). The model, as described in 40 CFR Part 50, Appendix W and the OCD User's Guide is downloaded from the USEPA website SCRAM for use along with several preprocessors. It is a straight line steady-state Gaussian model which predicts hourly average concentrations based on hourly input meteorology and hourly emissions from the modeled sources.

The air quality model for over-water impacts is the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) Modeling System with meteorological data prepared using the AERCOARE meteorological data preprocessor program. AERCOARE is used to implement the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm. US Wind has requested approval from USEPA to use AERMOD in conjunction with AERCOARE prepared meteorological data (AERCOARE-AERMOD) as an alternative model for assessing compliance with air quality standards for the Project emission sources located over water in lieu of the OCD model, which is the Guideline on Air Quality Models (40 CFR 51 Appendix W) preferred model for over-water dispersion.

The COARE bulk flux algorithm consists of equations that utilize air-sea temperature difference, overwater humidity and wind speed to parameterize the boundary layer parameters such as sensible heat, latent heat, and momentum fluxes. Even though the COARE algorithm was originally developed based on measurements in the tropics, it has since been improved, expanding its applicability outside of tropical environments. The meteorological preprocessor, AERCOARE, which implements Version 3.0 of the COARE algorithms, is used to generate model-ready meteorological data for use with AERMOD, which is the current USEPA preferred model for short-range (within 50 kilometers) dispersion modeling.

USEPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) lists AERCOARE[9] as an alternative model and states that the output from AERCOARE can be used by AERMOD in a marine environment. The SCRAM website indicates that, an AERMOD-COARE approach was approved by USEPA Region 10, with concurrence from the USEPA Model Clearinghouse, as an alternative model to OCD for application in an Arctic ice-free environment. In that application, the COARE algorithm was applied to overwater measurements and the results assembled in a spreadsheet. AERCOARE replaces the need for post-processing with a spreadsheet, provides support for missing data, adds options for the treatment of overwater mixing heights, and can consider many different input data formats.

On April 1st, 2011, USEPA Region 10 granted approval for the use of output from the COARE algorithm coupled with AERMOD to estimate ambient air pollutant concentrations in an ice-free marine environment[10,11]. Since the EPA Region 10 approval in May 2011, there have been eight (8) additional USEPA Model Clearinghouse approvals to use AERMOD-AERCOARE. As enumerated below all but one of the approvals are for offshore wind energy projects:

- November 2019, EPA Region 6, Sea Port Oil Terminal (SPOT), Gulf of Mexico
- January 2022, EPA Region 1, Vineyard Wind, OCS off the coast of Martha's Vineyard, MA
- July 2022, EPA Region 1, Park City Wind, OCS off the coast of Martha's Vineyard, MA
- July 2022, EPA Region 2, Empire Wind, OCS off the coast of Long Island, New York
- July 2022, EPA Region 2, Atlantic Shores, OCS off the coast of New Jersey
- November 2022, EPA Region 3, Dominion Coastal Virginia Offshore Wind-Commercial wind farm project, OCS off the coast of Virginia
- December 2022, EPA Region 1, Beacon Wind, OCS off the coast of Massachusetts
- December 2022, EPA Region 1, Mayflower Wind, OCS off the coast of Massachusetts

As documented in all of the recent approvals (including the most representative of the US Wind Maryland Project, which is the Dominion Coastal Virginia Offshore Wind Project off the coast of Virginia), the AERCOARE-AERMOD model was approved for use in an arctic marine ice-free environment because it satisfied the five criteria contained in Section 3.2.2.e of USEPA's Guideline.

9 https://www.epa.gov/scram/air-quality-dispersion-modeling-related-model-support-programs

10 COARE Bulk Flux Algorithm to Generate Hourly Meteorological Data for Use with the AERMOD Dispersion Program; Section 3.2.2.e Alternative Refined Model Demonstration, Herman Wong, USEPA to Tyler Fox, USEPA, April 1, 2011.

11 Model Clearinghouse Review of AERMOD-COARE as an Alternative Model for Application in an Arctic Marine Ice-Free Environment, George Bridgers, USEPA to Herman Wong, USEPA, May 6, 2011.

AERCOARE-AERMOD offers the following technical advantages, options, and features:

- The Plume Rise Model Enhancements (PRIME) downwash algorithm can be used to assess impacts in the cavity and wake regions of structures.
- The AERCOARE/AERMOD model does provide for the multi-tiered screening approach for NO_2 modeling (specifically the Tier 2 ARM2 or Tier 3 PVMRM/OLM refined screening approaches);
- Output can be generated in the statistical form that is needed to assess compliance with the newer statistically based NAAQS, such as 1-hour NO_2, and PM2.5.
- The AERMOD-AERCOARE model can model multiple line sources and multiple area sources within the same model run and does not limit the number of sources that can be modeled simultaneously.
- Calm wind conditions can be processed by the AERMOD-AERCOARE model.
- The dispersion algorithms used in the AERMOD portion of AERCOARE-AERMOD are considered state-of-art by USEPA.
- AERMOD incorporates options for the inclusion of varying ambient background concentrations by season and hour of day during the model run. In contrast, OCD does not have an option to incorporate ambient background concentrations within the model. Ambient background concentrations could be applied to the OCD predicted concentrations in a postprocessing step. A custom postprocessor for OCD would need to be developed.
- AERCOARE-AERMOD does not artificially limit the number of receptors that can be considered in an analysis.
- AERCOARE will directly accept WRF data model predicted hourly meteorological output from the Mesoscale Model Interface (MMIF) program.

The proximity to the shore and the WRF data model predicted hourly meteorological data suggests that steady-state Gaussian modeling with AERMOD should be sufficient to characterize airflow.

4.2 Meteorological Data

For any air quality modeling analysis conducted using the AERMOD model, two meteorological datasets are required: 1) hourly surface data and 2) upper air sounding data. According to the Guideline on Air Quality Models (Revised) (2017), the meteorological data used in an air quality modeling analysis should be selected based on its spatial and climatological representativeness of a proposed facility site and its ability to accurately characterize the transport and dispersion conditions in the area of concern. The spatial and climatological representativeness of the meteorological data are dependent on four factors:

1. The proximity of the meteorological monitoring site to the area under consideration;
2. The complexity of the terrain;
3. The exposure of the meteorological monitoring site; and,
4. The period of time during which data were collected.

The modeling analysis will use prognostic meteorological data. This is appropriate because there is no representative National Weather Service (NWS) station and given the offshore nature of the Projects it is infeasible to collect adequately representative site-specific data. In addition, there are only two active buoys that collect meteorological data in the area, the Ocean City Inlet Buoy and the Delaware Bay 26 NM Buoy (ID #44009), which is 19 miles offshore of Ocean City. To run AERCOARE, the overwater meteorological file contains the necessary hourly observations to estimate surface fluxes using the COARE algorithm, plus additional variables that are directly passed through to AERMOD. Buoy data can be used with AERCOARE, provided that it meets USEPA completeness requirements described under section 8.4.3 of Appendix W (at least 90% annual and at least 90% per calendar quarter, on average, across the 5 years processed).

The minimum set of overwater observations for the COARE algorithm must include wind speed, air temperature, sea temperature, and relative humidity. As an alternative to measured data, the USEPA MMIF program can also be applied to create an overwater meteorological file suitable for AERCOARE using simulations from WRF.

US Wind assessed a recent five year period (2017-2021) of meteorological data collected at the Ocean City Inlet Buoy and the Delaware Bay 26 NM Buoy, offshore of Ocean City. Neither of these buoys collect the relative humidity data that are necessary inputs to AERCOARE. In addition, the annual capture statistics were calculated from the period 2017-2021 and it was determined that the primary meteorological variables had capture statistics ranging from 88.6 to 92.7% for the Ocean City Inlet Buoy and from 38% to 64% for the Delaware Bay Buoy. Thus, the meteorological data from the nearest buoys does not meet the USEPA minimum criteria for completeness requirements on an annual basis. Based on the poor capture criteria statistics and absence of relative humidity data, the two buoys are not suitable for use with the AERCOARE model.

As such, US Wind has requested and received prognostic (i.e., WRF data) data from USEPA Office of Air Quality Planning and Standards (OAQPS). USEPA processed the WRF data using the MMIF (Version 4.0) to convert the WRF prognostic meteorological data (2019-2021) into a format suitable for dispersion modeling applications. The USEPA utilized the default settings for AERCOARE processing as provided in the User's Manual to the Mesoscale Model Interface Program, Version 4.0 (June 9, 2022). Note that setting options specific to AERMET processing, such as AER_MIXHT and AER_MIN_SPEED, are not applicable to AERCOARE processing.

US Wind intends to run AERCOARE using the following settings recommended in USEPA's AERCOARE User's Guide, as specified below:

1. The default threshold wind speed will be used to identify calm hours (i.e., WSCALM = 0.5 m/s). Wind speeds below this value will be considered calms;
2. Mixing heights provided by WRF-MMIF will be used, instead of calculated by AERCOARE. The default minimum mixing height of 25 meters will be assigned.
3. Warm layer and cool-skin effects will not be considered.
4. Friction velocity will be determined from wind speed only; wave-height will not be considered.

The AERCOARE parameters noted above were previously approved by USEPA Regions 2 and 3 and USEPA OAQPS in their approvals of the Alternative Model Request for the Dominion Coastal Virginia Offshore Wind-Commercial Wind Farm and Atlantic Shores Projects.

Use of prognostic meteorological data requires concurrence from the appropriate reviewing authority and collaborating agencies that the data are of acceptable quality and representative of the modeling application. Appendix B provides an analysis following the procedures in the USEPA's Evaluation of Prognostic Meteorological Data in AERMOD Applications Guidance Document, to document that the prognostic meteorological data is acceptable for use in this modeling application. The output from AERCOARE will be used as the meteorological database for the modeling analysis and consists of a surface data file and a vertical profile data file.

4.3 AERMOD Model Options

AERMOD (version 22112) will be used for the modeling of the proposed Project's potential emissions to determine the maximum ambient air concentrations. The regulatory default option will be used in the dispersion modeling analysis.

4.4 Receptor Grid

When assessing compliance with NAAQS and Class II PSD increments, the receptors in closest proximity to the emission sources are mostly over water. There cannot possibly be any residences over water, and the public is extremely unlikely to remain for any extended period in any of the overwater locations being modeled. The standards were established to be protective of public health based on repeated or prolonged exposure, and the possibility of repeated or prolonged exposure does not exist miles offshore.

For NAAQS and PSD Class II modeling, a polar grid of receptors will be utilized in which receptors are placed in 10-degree increments around the ring. Receptor ring spacing will be 25 m out to 1000 m, 250 m out to 2,500 m, 500 m out to 5,000 m, 2.5 km out to 10 km, and 5 km out to 50 km. Based on the results of the modeling, the receptor field may be refined to ensure that the maximum impacts from the different construction and O&M activities are being captured. It should be noted that the receptors are nearly entirely over water, in locations where there are no residences, and where the public is unlikely to remain for any extended period of time.

The modeled receptors will vary based on the type of construction and O&M activity. For example, during construction, it is assumed that a 500-meter exclusion zone will be established to keep the public away from the immediate area of the activity. The details of the safety zone are provided in the Project's *Navigation Safety Risk Assessment* (US Wind, May, 2022) that has been provided to the BOEM as part of the Construction and Operations Plan (COP). The receptor field will be placed adjacent to the activity in areas where the public could have access. For the purposes of modeling, it is assumed that the construction vessels are located at the center of the receptor grid and the exclusion zone is 500 m in all directions.

For PSD Class I modeling, receptors will be placed at a distance of 50 km to conservatively model the impacts at the Brigantine NWR. A ring of polar receptors will be placed 50 km from the centroid of the WDA. Receptors will be placed at each degree, for a total of 360 receptors. This methodology is very conservative as it models the Brigantine NWR at all wind directions at 50 km from the centroid of the WDA. If this initial screening methodology proves to be too conservative, the modeled receptor grid will be limited to those wind directions from the Project centroid that would potentially impact the Brigantine NWR.

4.5 NO_2 Modeling

The following tiered screening options will be applied for the various analyses per the guidance specified in the "Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter", published final in the Federal Register on January 17, 2017, and the USEPA Memorandum "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" section entitled Approval and Application of Tiering Approach for NO2 (found on pages 5 through 8 of the memorandum). US Wind proposes to use the Tier 2 screening approach for initial modeling results using the Ambient Ratio Method 2 (ARM2), which provides estimates of representative equilibrium ratios of NO_2/NOx values based on ambient levels of NO_2 and NO_x derived from national data from the USEPA's Air Quality System. The national default for ARM2 is proposed to be used and includes a minimum ambient NO_2/NO_x ratio of 0.5 and maximum ambient NO_2/NOx ratio of 0.9. This method will be applied to both the SIL and NAAQS/increment analyses, respectively for the 1-hour and annual averages. Note that the use of the Tier 3 screening approach applying PVMRM, as discussed below, may be utilized should the Tier 2 method prove too conservative during the single source and or any potential multisource modeling analyses for NAAQS compliance.

PVMRM incorporates three sets of data into the calculation of 1-hour NO_2 concentrations. Those are source-specific in-stack NO_2/NO_x emission rate ratios, an ambient NO_2/NO_x equilibrium concentration ratio, and hourly average background ozone concentrations. The PVMRM option for modeling conversion of NO to NO_2 will incorporate a default NO_2/NO_x ambient equilibrium concentration ratio of 0.90.

In Stack NO_2/NO_x Concentration Ratio

NO_x consists primarily of nitric oxide (NO) and NO_2, plus small amounts of other compounds. Combustion sources produce NO_x by the following three mechanisms:

1. Thermal NOx is produced by the thermal dissociation and subsequent reaction of nitrogen and oxygen (O_2) molecules in the combustion air;
2. Fuel NOx is produced by the reaction of fuel-bound nitrogen compounds with O_2 molecules in the combustion air; and,
3. Prompt NO_x is produced by the formation of hydrogen cyanide (HCN) via the reaction of nitrogen radicals and hydrocarbons (HC), followed by the oxidation of HCN to NO.

NO_2 is produced by the oxidation of NO by O_2. This oxidation reaction is favored by a high O_2 concentration. Since the reaction is exothermic, NO_2 formation is also favored by low temperature. Hence, rapid cooling of combustion products in the presence of a high O_2 concentration will promote conversion of NO to NO_2. Essentially all of the NO_x formed by distillate oil combustion sources is thermal NO_x because this fuel has little or no chemically bound fuel nitrogen. NO_x from fuel combustion typically consists of 90 to 95 percent NO. The balance is primarily NO_2.

The PVMRM modeling analysis will conservatively utilize the national default in-stack NO_2/NO_x ratio of 0.5. Note that the use of the USEPA NO_2/NO_x In-Stack Ratio (ISR) Database may be utilized should the default in-stack ratio prove too conservative during the single source and or any potential multisource modeling analyses for NAAQS compliance. The

USEPA ISR database will be reviewed to determine representative NO_2/NO_x ratios for the specific emissions sources that do not utilize the default in-stack ratio.

1-hour NO_2 Background Concentrations

Pollutant background concentrations are required to appropriately assess the ambient air quality concentrations that may contribute to the total ambient pollutant concentrations. Background concentrations are added to model-predicted concentrations to calculate the total concentrations for comparison to the NAAQS. Criteria pollutant background concentration values are derived from ambient air quality data monitored at stations that are determined to be representative of expected background concentrations at the proposed source location and potential impact area. In order to conduct NAAQS assessments, background values must be combined with modeled results to compare to the 1-hour NO_2 NAAQS.

Based on review of the locations of Maryland, Delaware, and New Jersey ambient air quality monitoring sites, the closest "regional" monitoring site will be used to represent the current background NO_2 air quality in the site area. Background data for NO_2 from 2019-2021 will be obtained from a monitoring station located in Millville, New Jersey (EPA AIRData # 34-011-0007).

The March 1, 2011 Fox memorandum "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO_2 NAAQS (USEPA, March 1, 2011) provides guidance for incorporating background concentrations in the impact assessment for the 1-hour NO_2 standard.

"*We believe that an appropriate methodology for incorporating background concentrations in the cumulative impact assessment for the 1-hour NO_2 standard would be to use multiyear average of the 98th-percentile of the available background concentrations by season and hour-of-day…*"

"*…we recommend that background values by season and hour-of-day used in the context should be based on the 3rd highest values for each season and hour of day combination…*"

This seasonal and hour of day methodology is proposed to be used. The background values will be first divided by season for each year. Those seasonal groups will be further binned into 24-hour groups for a total of 96 bins of values (product of 4 seasons and 24 hours) for each year (2019, 2020, and 2021). The 3rd highest value from each bin will be found per year. Finally, to obtain the values to be summed with the modeled concentrations, the average of those 3rd highest values will be taken over three (3) years. This results in 96 values proposed to be used in the modeling analysis. The AERMOD model option (keyword BACKGROUND) will be used to sum each modeled concentration with the background concentration that was calculated for that season and hour-of-day.

Hourly Average Background Ozone Concentrations

Based on review of the locations of ambient air quality monitoring sites, the closest "regional" monitoring site will be used to represent the current background ozone air quality in the site area. Representative hourly average background ozone concentrations will be input to AERMOD. The ozone monitor closest to the proposed Project site has been identified. After reviewing monitoring locations and periods of record, a monitor in Lewes, Delaware (USEPA AIRData # 10-005-1003) is proposed to represent the ozone background values during the three (3) year period 2019–2021, concurrent with the three (3) years of surface meteorological data. When ozone data is missing from the Lewes monitor, missing hours will be substituted using data from 2nd nearest monitoring station, located in Seaford, Delaware (10-005-1002).

4.6 Background Ambient Air Quality

The model results from the preliminary analysis are added to the background concentration before comparison to the NAAQS. The background concentration from the nearest monitor for each pollutant are presented in Table 4-1. The USEPA website (https://www.epa.gov/outdoor-air-quality-data) is the source for the background data. Values in the table reflect the statistical nature of the NAAQS.

Background concentrations are based on monitoring locations in Maryland, Virginia, Delaware, and New Jersey. In each state there are major cities and rural areas. The setting for the Project is adjacent to the beaches along the Delaware and Maryland shores where there are no significant stationary emission sources. The Lewes site is just 7 nautical miles north of the centroid of the Project area and measures just ozone and sulfur dioxide. Millville is a site in southern New Jersey near the Delaware Bay and not as far away as Wilmington. There are very few locations that measure PM_{10} but because there are fugitive dusts sources nearby, the only location is at Hampton Roads, Virginia. Carbon monoxide is not measured in large metropolitan areas and Wilmington, Delaware is the closest to the Project.

The entire area of the Delmarva Peninsula is attainment for ozone with the exception of the Wilmington area. Concentrations on the peninsula are around 60 ppb and have been dropping. Background concentrations of the remainder of the criteria pollutants are low. For the other pollutants, concentrations in the large metropolitan areas of each state are much higher. For CO, Washington, D.C., and Philadelphia are in non-attainment. There is a nonattainment area for SO_2 around Baltimore. There are non-attainment areas for $PM_{2.5}$

from Wilmington northward through Pennsylvania and New Jersey. These non-attainment areas are not modeled for increased impact but the areas near non-attainment areas will need to be modeled for transit emissions.

USEPA has published SILs for the criteria pollutants. If the modeled impact of emissions from a source are below the SIL then it is generally expected that the emissions will not cause a violation of the NAAQS. This is especially true if the SIL is much less than the delta between the NAAQS and the background concentration. The comparison for the proposed Project background concentrations is shown in Table 4-2.

As shown in Table 4-2, the delta between the NAAQS and background concentrations is significant and the NAAQS would not be violated if the SIL concentration is added to the background.

4.7 NAAQS Analysis

Should modeled concentrations be greater than the SILs for one or more pollutants subject to PSD review, NAAQS analyses for those pollutants will be performed. The first step of conducting the NAAQS analysis will be to determine the pollutant specific area(s) of impact of the proposed Project. The area of impact corresponds to the distance at which the model calculated pollutant concentrations fall below the SILs. The second step is obtaining off-site major source inventories within the area of impact plus a distance to be determined based upon discussions with MDE. Discussions with MDE will be centered on the development of an off-site source inventory and the procedures recommended for preparing a multiple source inventory. Off-site major sources in the inventory would be included in the NAAQS modeling analysis along with all Project sources. The resultant concentrations will then be added to the representative background concentration for comparison to the NAAQS. If the modeled concentration plus the background concentration is less than the NAAQS, the proposed Project is considered compliant with the NAAQS.

4.8 PSD Increment Analysis

The Project is located in a PSD Class II area. The modeling analysis will demonstrate that the emissions from the Project would not cause or contribute to air pollution in violation of any of the applicable PSD Class I or II increments presented in Table 3-4.

There is one (1) Class I area within 300 km of the Project: the Brigantine Wilderness area located in the Edwin B. Forsythe National Wildlife Refuge in New Jersey, approximately 136 kilometers north of the Project. Based on the spatial limitations of the AERMOD model, a

PSD Class I increment analysis will conservatively be performed at a distance of 50 km from the centroid of the OCS area.

4.9 Ozone and $PM_{2.5}$ Attainment Issues

Although the Project centroid is not in or close to non-attainment areas for ozone or $PM_{2.5}$, analysis will be performed to evaluate whether the emissions from the Project will impact the non-attainment areas (emissions from the non-attainment area [port activities] will need to be offset). USEPA has recently finalized its Guidance for Ozone and Fine Particulate Matter Permit Modeling (June 29, 2022). This Guidance relies upon the Tier 1 Demonstration for Modeled Emission Rates for Precursors of Ozone and $PM_{2.5}$ (MERPS). A MERPS analysis will be performed to determine if enough annual emissions will cause an impact in the non-attainment areas.

Additionally, USEPA has recently (November 2022) issued "Photochemical Model Estimated Relationships Between Offshore Wind Energy Project Precursor Emissions and Downwind Air Quality (O_3 and PM2.5) Impacts", EPA-454/R-22-007. This document provides the results of photochemical model analysis for the area near the Project, at the location of the project centroid (i.e., Source #5 referenced in the document). Because the activities of this wind energy application are close to shore, it is not expected that high concentrations of chemically produced ozone or particles will occur at the near shore. The transfer coefficients for source #5 and the potential Project air emissions will be used to calculate the secondary formation of PM2.5 for inclusion into assessment.

4.10 Additional Impact Analyses

In addition to assessing impacts on the NAAQS and PSD increments, facilities subject to PSD review must assess the potential impact for the area as a result of growth, and the potential impacts to soils, vegetation, and visibility in the area surrounding the proposed facility.

4.10.1 Assessment of Impacts Due to Growth

The Project will be reviewed to assess the potential for affecting local and regional industrial, commercial, and residential growth. Factors that will be examined include the effects the transient working force will have during construction. If an increase in the permanent working force is required, the effects on the local growth will also be examined. Other effects to growth that will be examined include the air quality constraints the emissions from the Project will have on precluding new growth, and the potential for drawing new industrial growth due to the electricity generated.

4.10.2 Assessment of Impacts on Soils and Vegetation

Pursuant to the PSD regulations, an assessment of the potential impacts of the Project on soils and vegetation will be prepared. The methodology outlined in A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals, U.S. EPA 450/2-81-078 will be used. This assessment will compare the maximum-modeled Project impacts plus background to pollutant-specific concentration levels. These pollutant-specific concentration levels are minimum pollutant concentration levels at which damage to the natural vegetation and predominant crops could occur. Therefore, if the maximum-modeled concentrations are less than the pollutant-specific concentration levels, then no damage to vegetation will be anticipated.

Most of the designated vegetation screening levels are equivalent to or exceed NAAQS and/or PSD increments, so that satisfaction of NAAQS and PSD increments assures compliance with sensitive vegetation screening levels.

4.10.3 Impact on Visibility

An assessment of the Project's potential impact on visibility from its emissions within the nearest surrounding area (i.e., Ocean City, MD) will be performed using the USEPA VISCREEN model (version 13190).

Table 4-1: Maximum Measured Ambient Air Quality Concentrations

Pollutant	Averaging Period	2019	2020	2021	Background	Location	NAAQS
		Concentration (μg/m³ unless noted)					
CO (ppm)	1-Hour	1.2	1.8	1.4	**1.8**	Wilmington	35
	8-Hour	1	1.3	0.9	**1.3**	Wilmington	9
NO_2	1-Hour	35	32	34	**33.67**	Millville	188
	Annual	6.31	6.33	6.3	**6.33**	Millville	100
PM10	24-Hour	20	20	44	**44.0**	Hampton	150
PM2.5	24-Hour	19	16	19	**18.00**	Millville	35
	Annual	7.8	8.3	7	**7.70**	Millville	12
SO_2	1-Hour	1	2	1	**1.33**	Lewes	196
	24-Hour	0.4	0.4	0.3	**0.4**	Lewes	365
O2 (ppb)	8-Hour	58	60	61	**59.67**	Lewes	80

Notes:

1. High second-high short term (1-, 8-, and 24-hour) and maximum annual average concentrations presented for all pollutants other than PM-2.5 and 1-hour SO_2 and NO_2.
2. Bold values represent the proposed background values for use in any necessary NAAQS/NYAAQS analyses.

Table 4-2: Difference Between Monitored Concentrations and NAAQS to the SILs

Pollutant	Averaging Period	Background Concentration	NAAQS	NAAQS-Background	SIL
		(µg/m3 except as noted)			
CO (ppm)	1-Hour	1.8	35	33.2	1.75
	8-Hour	1.3	9	7.7	0.45
NO_2	1-Hour	33.67	188	154.33	7.5*
	Annual	6.33	100	93.67	1
PM10	24-Hour	44.0	150	106	5
PM2.5	24-Hour	18.00	35	17	1.2*
	Annual	7.70	12	4.3	0.2*
SO2	1-Hour	1.33	196	194.67	7.9*
	24-Hour	0.4	365	364.6	5

Notes:

*Guidance not regulation

5.0 REFERENCES

U.S. EPA, 1980. A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals. EPA 450/2-81-078. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. December 1980.

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U.S. EPA, 1990. "New Source Review Workshop Manual, Draft". Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Research Triangle Park, North Carolina.

U.S. EPA, 2011. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO2 NAAQS. March 1, 2011.

U.S. EPA, 2017. Revisions to the Guideline on Air Quality Models (Revised). Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter. Appendix W to Title 40 U.S. Code of Federal Regulations (CFR) Parts 51 and 52, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. January 17, 2017.

U.S. EPA, 2022. Guidance on the Ozone and Fine Particulate Modeling. Office of Air Quality Planning and Standards. July 19, 2022.

U.S. EPA, 2022. Photochemical Model Estimated Relationships Between Offshore Wind Energy Project Precursor Emissions and Downwind Air Quality (O3 and PM2.5) Impacts. Office of Air Quality Planning and Standards. November 2022.

US Wind, Inc. 2022. Notice of Intent to Submit an Application for an Outer Continental Shelf Air Permit Maryland Offshore Wind Project. August 2022.

US Wind, Inc. 2022. Construction and Operations Plan. Submitted to the Bureau of Ocean Energy Management. May 2022.

Appendix A
Preliminary Source Parameters

Activity	Representative Vessel Type	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	Engine Load Factor (%)	Homeport During Project	NOx (lb/hr)	CO (lb/hr)	PM-10 (lb/hr)	PM-2.5 (lb/hr)	SO_2 (lb/hr)
OCS Air Permit Emissions During Construction																
Scour Protection Installation																
Scour protection installation vessel	Fallpipe vessel	Main Engine - In Transit		4,500	13,500	33	1.01	5.13	555	0.83	Sparrows Point	260.61	61.26	5.19	5.03	9.88
		Main Engine - Maneuvering	3	4,500	13,500	33	1.01	5.13	555	0.4		125.60	29.52	2.50	2.42	4.76
		Auxiliary Engines - Transit		492	492	33	1.65	0.26	555	0.27		3.09	0.73	0.06	0.06	0.12
		Auxiliary Engines - Maneuvering	2	1200	1200	33	1.65	0.63	555	0.45		12.56	2.95	0.25	0.24	0.48
Foundation Installation																
Foundation installation vessel	Heavy lift vessel	Main Engine - In Transit		4,500	22,500	33	1.01	5.13	555	0.83	Sparrows Point	434.35	102.10	8.65	8.38	16.47
		Main Engine - Maneuvering		4,500	22,500	33	1.01	5.13	555	0.40		209.33	49.21	4.17	4.04	7.94
		Auxiliary Engines - Transit		4500	4500	33	1.01	6.77	555	0.27		28.26	6.64	0.56	0.55	1.07
		Auxiliary Engines - Maneuvering	6	4500	4500	33	1.01	6.77	555	0.45		47.10	11.07	0.94	0.91	1.79
Tug for assisting foundation installation 1	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Tug for assisting foundation installation 2	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Foundation transport tug 1	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Foundation transport tug 2	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Foundation transport tug 3	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Crew transfer vessel 1	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Noise mitigation vessel	Anchor handling tug supply	Main Engine - In Transit		3,310	6,620	6	0.61	10.28	555	0.83	Sparrows Point	127.80	30.04	2.54	2.47	4.85
		Main Engine - Maneuvering	2	3,310	6,620	6	0.61	10.28	555	0.4		61.59	14.48	1.23	1.19	2.34
		Auxiliary Engines - Transit		77	77	6	0.25	1.77	555	0.27		0.48	0.11	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	4	499	1497	6	0.25	11.47	555	0.45		15.67	3.68	0.31	0.30	0.59
Acoustic monitoring	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Marine mammal observation 1	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Environmental monitoring	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Heave compensation system	Compensation system	Hydraulic power unit engines	3	510	1,530	3.1	0.20	33.73	700	1.00	N/A	4.38	11.81	0.10	0.10	0.02
Pile driving hammer	Hammer engine	Engines	3	747	2,241	27.5	0.15	116.58	555	1.00	N/A	6.42	17.29	0.15	0.14	0.03
Noise mitigation device	Oil-free air compressor	Engines	20	399	7980	3.1	0.20	33.73	700	1.00	N/A	22.87	61.57	0.53	0.51	0.11
Secondary work, snagging, and possibly grouting	Tug	Main Engine - In Transit		2540	5080	6	0.46	2.29	555	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.46	2.29	555	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.06	8.86	555	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.06	8.86	555	0.56		2.59	0.61	0.05	0.05	0.10

Activity	Representative Vessel Type	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	Engine Load Factor (%)	Homeport During Project	NOx (lb/hr)	CO (lb/hr)	PM-10 (lb/hr)	PM-2.5 (lb/hr)	SO_2 (lb/hr)
OCS Air Permit Emissions During Construction																
WTG Installation																
WTG installation jack-up vessel	Jack-up installation vessel	Main Engine - In Transit		5,760	5,760	43	1.01	3.29	555	0.83	Sparrows Point	111.19	26.14	2.21	2.15	4.22
		Main Engine - Maneuvering	3	4,230	8,460	43	1.01	2.41	555	0.2		39.35	9.25	0.78	0.76	1.49
		Auxiliary Engines - Transit		2,880	2,880	43	0.60	11.40	555	0.27		18.09	4.25	0.36	0.35	0.69
		Auxiliary Engines - Maneuvering	1	2,880	2,880	43	0.60	11.40	555	0.45		30.14	7.09	0.60	0.58	1.14
Jack-up vessel for WTG transport 1	Jack-up vessel	Main Engine - In Transit		2,350	4,700	43	0.60	6.55	879	0.83	Sparrows Point	90.73	21.33	1.81	1.75	3.44
		Main Engine - Maneuvering	2	2,350	4,700	43	0.60	6.55	879	0.2		21.86	5.14	0.44	0.42	0.83
		Auxiliary Engines - Transit		1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
		Auxiliary Engines - Maneuvering	2	1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
Jack-up vessel for WTG transport 2	Jack-up vessel	Main Engine - In Transit		2,350	4,700	43	0.60	6.55	879	0.83	Sparrows Point	90.73	21.33	1.81	1.75	3.44
		Main Engine - Maneuvering	2	2,350	4,700	43	0.60	6.55	879	0.2		21.86	5.14	0.44	0.42	0.83
		Auxiliary Engines - Transit		1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
		Auxiliary Engines - Maneuvering	2	1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
Jack-up vessel for WTG transport 3	Jack-up vessel	Main Engine - In Transit		2,350	4,700	43	0.60	6.55	879	0.83	Sparrows Point	90.73	21.33	1.81	1.75	3.44
		Main Engine - Maneuvering	2	2,350	4,700	43	0.60	6.55	879	0.2		21.86	5.14	0.44	0.42	0.83
		Auxiliary Engines - Transit		1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
		Auxiliary Engines - Maneuvering	2	1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
Tug to support WTG Installation 1	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Tug to support WTG Installation 2	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Tug to support WTG Installation 3	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Crew transfer vessel 1	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Crew transfer vessel 2	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Crew transfer vessel 3	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02

Activity	Representative Vessel Type	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	Engine Load Factor (%)	Homeport During Project	NOx (lb/hr)	CO (lb/hr)	PM-10 (lb/hr)	PM-2.5 (lb/hr)	SO_2 (lb/hr)
OCS Air Permit Emissions During Construction																
WTG Commissioning Works																
WTG diesel generators	40 kW standard diesel	Engine	1	40	40	3	0.10	28.16	844	1.00	N/A	0.11	0.31	0.003	0.003	0.001
WTG diesel generators	generator - hot	Engine	3	40	120	3	0.10	28.16	844	1.00	N/A	0.34	0.93	0.01	0.01	0.002
WTG diesel generators	generator - preservation	Engine	1	40	40	3	0.10	28.16	844	1.00	N/A	0.11	0.31	0.003	0.003	0.001
Crew transfer vessel 1	Crew transfer vessel	Main Engine - In Transit	2	749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering		749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Crew transfer vessel 2	Crew transfer vessel	Main Engine - In Transit	2	749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering		749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Service operation vessel	Service operation vessel	Main Engine - In Transit	2	2,400	4,800	16	0.60	8.51	555	0.83	Sparrows Point	92.66	21.78	1.84	1.79	3.51
		Main Engine - Maneuvering		2,400	4,800	16	0.60	8.51	555	0.4		44.66	10.50	0.89	0.86	1.69
		Auxiliary Engines - Transit	4	550	550	16	0.46	7.78	555	0.56		7.16	1.68	0.14	0.14	0.27
		Auxiliary Engines - Maneuvering		910	2,730	16	0.46	4.70	555	0.56		35.56	8.36	0.71	0.69	1.35

Activity	Representative Vessel Type	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	Engine Load Factor (%)	Homeport During Project	NOx (lb/hr)	CO (lb/hr)	PM-10 (lb/hr)	PM-2.5 (lb/hr)	SO_2 (lb/hr)
OCS Air Permit Emissions During Construction																
OSS Installation																
OSS installation	Heavy lift vessel	Main Engine - In Transit		4,500	22,500	33	1.01	5.13	555	0.83	Sparrows Point	434.35	102.10	8.65	8.38	16.47
		Main Engine - Maneuvering		4,500	22,500	33	1.01	5.13	555	0.40		209.33	49.21	4.17	4.04	7.94
		Auxiliary Engines - Transit		4,500	4,500	33	1.65	0.26	555	0.27		28.26	6.64	0.56	0.55	1.07
		Auxiliary Engines - Maneuvering	6	4,500	4,500	33	1.65	0.63	555	0.45		47.10	11.07	0.94	0.91	1.79
Assisting tug 1	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Assisting tug 2	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
OSS Transport	Tug	Main Engine - In Transit		2,540	5,080	6	0.6	4.95	610	0.83	Sparrows Point	98.07	23.05	1.95	1.89	3.72
		Main Engine - Maneuvering	2	2,540	5,080	6	0.6	4.95	610	0.2		23.63	5.55	0.47	0.46	0.90
		Auxiliary Engines - Transit		199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
		Auxiliary Engines - Maneuvering	1	199	199	6	0.15	23.06	897	0.56		2.59	0.61	0.05	0.05	0.10
Crew transfer vessel	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Service boat	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Refueling operations to OSS	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
OSS emergency generators	150 kW standard diesel generator	Engine	4	150	600	53	0.10	105.60	844	1.00	N/A	1.72	4.63	0.04	0.04	0.01
Crew Hotel Vessel	Jack-up vessel	Main Engine - In Transit		2,350	4,700	43	0.60	6.55	879	0.83	Sparrows Point	90.73	21.33	1.81	1.75	3.44
		Main Engine - Maneuvering	2	2,350	4,700	43	0.60	6.55	879	0.2		21.86	5.14	0.44	0.42	0.83
		Auxiliary Engines - Transit		1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
		Auxiliary Engines - Maneuvering	2	1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
Scour protection installation vessel	Fallpipe vessel	Main Engine - In Transit		4,500	13,500	33	1.01	5.13	555	0.83	Sparrows Point	260.61	61.26	5.19	5.03	9.88
		Main Engine - Maneuvering	3	4,500	13,500	33	1.01	5.13	555	0.4		125.60	29.52	2.50	2.42	4.76
		Auxiliary Engines - Transit		492	492	33	1.65	0.26	555	0.27		3.09	0.73	0.06	0.06	0.12
		Auxiliary Engines - Maneuvering	2	1200	1200	33	1.65	0.63	555	0.45		12.56	2.95	0.25	0.24	0.48

Activity	Representative Vessel Type	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	Engine Load Factor (%)	Homeport During Project	NOx (lb/hr)	CO (lb/hr)	PM-10 (lb/hr)	PM-2.5 (lb/hr)	SO_2 (lb/hr)
OCS Air Permit Emissions During Construction																
Inter-Array Cable Installation																
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	Main Engine - In Transit		1,750	5,250	28	0.33	20.16	555	0.83	Sparrows Point	101.35	23.82	2.02	1.96	3.84
		Main Engine - Maneuvering		1,750	5,250	28	0.33	20.16	555	0.40		48.84	11.48	0.97	0.94	1.85
		Auxiliary Engines - Transit		1,750	1,750	28	0.33	42.83	555	0.85		34.60	8.13	0.69	0.67	1.31
		Auxiliary Engines - Maneuvering	4	1,750	1,750	28	0.33	42.83	555	0.85		34.60	8.13	0.69	0.67	1.31
Pre-lay grapnel run	Multipurpose offshore support vessel	Main Engine - In Transit		1611	1611	16	0.3	9.28	555	0.83	Sparrows Point	31.10	7.31	0.62	0.60	1.18
		Main Engine - Maneuvering	1	1611	1611	16	0.3	9.28	555	0.20		7.49	1.76	0.15	0.14	0.28
		Auxiliary Engines - Transit		123	246	16	0.15	9.46	555	0.56		3.20	0.75	0.06	0.06	0.12
		Auxiliary Engines - Maneuvering	2	123	246	16	0.15	9.46	555	0.56		3.20	0.75	0.06	0.06	0.12
Cable installation support vessel	Cable installation support vessel	Main Engine - In Transit		1840	1840	27	0.33	21.19	555	0.83	Sparrows Point	35.52	8.35	0.71	0.69	1.35
		Main Engine - Maneuvering		1380	2760	27	0.33	15.89	555	0.40		25.68	6.04	0.51	0.50	0.97
		Auxiliary Engines - Transit		1840	1840	27	0.33	45.04	555	0.85		36.38	8.55	0.72	0.70	1.38
		Auxiliary Engines - Maneuvering	4	1840	1840	27	0.33	45.04	555	0.85		36.38	8.55	0.72	0.70	1.38
Crew transfer vessel 1	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Crew transfer vessel 2	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Cable termination and commissioning crew transfer vessel	Cable installation support vessel	Main Engine - In Transit		1840	1840	27	0.33	21.19	555	0.83	Sparrows Point	35.52	8.35	0.71	0.69	1.35
		Main Engine - Maneuvering		1380	2760	27	0.33	15.89	555	0.40		25.68	6.04	0.51	0.50	0.97
		Auxiliary Engines - Transit		1840	1840	27	0.33	45.04	555	0.85		36.38	8.55	0.72	0.70	1.38
		Auxiliary Engines - Maneuvering	4	1840	1840	27	0.33	45.04	555	0.85		36.38	8.55	0.72	0.70	1.38
Trenching vessel	Purpose-built offshore construction/ROV/survey vessel	Main Engine - In Transit		3000	15000	43	0.67	7.79	555	0.83	Sparrows Point	289.57	68.07	5.76	5.59	10.98
		Main Engine - Maneuvering		3000	15000	43	0.67	7.79	555	0.40		139.55	32.80	2.78	2.69	5.29
		Auxiliary Engines - Transit		3000	3000	43	0.67	10.28	555	0.27		18.84	4.43	0.38	0.36	0.71
		Auxiliary Engines - Maneuvering	6	3000	3000	43	0.67	10.28	555	0.45		31.40	7.38	0.63	0.61	1.19
Remedial protection vessel	Fallpipe vessel	Main Engine - In Transit		4,500	13,500	33	1.65	1.90	555	0.83	Sparrows Point	260.61	61.26	5.19	5.03	9.88
		Main Engine - Maneuvering	3	4,500	13,500	33	1.65	1.90	555	0.4		125.60	29.52	2.50	2.42	4.76
		Auxiliary Engines - Transit		1200	1200	33	1.65	0.63	555	0.27		7.54	1.77	0.15	0.15	0.29
		Auxiliary Engines - Maneuvering	2	492	492	33	1.65	0.26	555	0.45		5.15	1.21	0.10	0.10	0.20
Preconstruction survey	Multi-role survey vessel	Main Engine - In Transit		392	784	7.6	0.20	14.50	664	0.83	Sparrows Point	15.13	3.56	0.30	0.29	0.57
		Main Engine - Maneuvering	2	392	784	7.6	0.20	14.50	664	0.40		7.29	1.71	0.15	0.14	0.28
		Auxiliary Engines - Transit		135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13
		Auxiliary Engines - Maneuvering	2	135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13

Activity	Representative Vessel Type	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	Engine Load Factor (%)	Homeport During Project	NOx (lb/hr)	CO (lb/hr)	PM-10 (lb/hr)	PM-2.5 (lb/hr)	SO_2 (lb/hr)
OCS Air Permit Emissions During Construction																
Offshore Export Cable Installation																
Offshore export cable transport, pre-lay survey, lay and pull	Cable lay vessel	Main Engine - In Transit		1,750	5,250	28	0.33	20.16	555	0.83	Sparrows Point	101.35	23.82	2.02	1.96	3.84
		Main Engine - Maneuvering		1,750	5,250	28	0.33	20.16	555	0.4		48.84	11.48	0.97	0.94	1.85
		Auxiliary Engines - Transit		1,750	1,750	28	0.33	42.83	555	0.85		34.60	8.13	0.69	0.67	1.31
		Auxiliary Engines - Maneuvering	4	1,750	1,750	28	0.33	42.83	555	0.85		34.60	8.13	0.69	0.67	1.31
Tow tug for CLV	Anchor handling tug supply	Main Engine - In Transit		1,825	3,650	28	0.33	20.20	555	0.83	Sparrows Point	70.46	16.56	1.40	1.36	2.67
		Main Engine - Maneuvering		1,825	3,650	28	0.33	20.20	555	0.20		16.98	3.99	0.34	0.33	0.64
		Auxiliary Engines - Transit		1,825	1,825	28	0.33	42.80	555	0.56		23.77	5.59	0.47	0.46	0.90
		Auxiliary Engines - Maneuvering	3	1,825	1,825	28	0.33	42.80	555	0.56		23.77	5.59	0.47	0.46	0.90
Pre-lay grapnel run	Multipurpose offshore support vessel	Main Engine - In Transit		1611	1611	16	0.3	9.28	555	0.83	Sparrows Point	31.10	7.31	0.62	0.60	1.18
		Main Engine - Maneuvering	1	1611	1611	16	0.3	9.28	555	0.2		7.49	1.76	0.15	0.14	0.28
		Auxiliary Engines - Transit		123	246	16	0.15	9.46	555	0.56		3.20	0.75	0.06	0.06	0.12
		Auxiliary Engines - Maneuvering	2	123	246	16	0.15	9.46	555	0.56		3.20	0.75	0.06	0.06	0.12
Boulder clearance	Cable installation support vessel	Main Engine - In Transit		1840	1840	27	0.33	21.19	555	0.83	Sparrows Point	35.52	8.35	0.71	0.69	1.35
		Main Engine - Maneuvering		1380	2760	27	0.33	15.89	555	0.4		25.68	6.04	0.51	0.50	0.97
		Auxiliary Engines - Transit		1840	1840	27	0.33	45.04	555	0.85		36.38	8.55	0.72	0.70	1.38
		Auxiliary Engines - Maneuvering	4	1840	1840	27	0.33	45.04	555	0.85		36.38	8.55	0.72	0.70	1.38
Remedial protection vessel	Fallpipe vessel	Main Engine - In Transit		4,500	13,500	33	1.65	1.90	555	0.83	Sparrows Point	260.61	61.26	5.19	5.03	9.88
		Main Engine - Maneuvering	3	4,500	13,500	33	1.65	1.90	555	0.4		125.60	29.52	2.50	2.42	4.76
		Auxiliary Engines - Transit		1200	1200	33	1.65	0.63	555	0.27		7.54	1.77	0.15	0.15	0.29
		Auxiliary Engines - Maneuvering	2	492	492	33	1.65	0.26	555	0.45		5.15	1.21	0.10	0.10	0.20
Dredging vessel	Trailing suction hopper dredger	Main Engine - In Transit		total provided	23,000	43	2.32	2.47	555	0.83	Sparrows Point	444.00	104.37	8.84	8.57	16.83
		Main Engine - Maneuvering	1	total provided	23,000	43	2.32	2.47	555	0.2		106.99	25.15	2.13	2.06	4.06
		Auxiliary Engines - Transit		total provided	4,550	43	2.32	1.29	555	0.27		28.57	6.72	0.57	0.55	1.08
		Auxiliary Engines - Maneuvering	1	total provided	4,550	43	2.32	1.29	555	0.45		47.62	11.19	0.95	0.92	1.81
Crew transfer vessel	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Sparrows Point	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.2		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Trenching vessel	Purpose built offshore construction/survey vessel	Main Engine - In Transit		3000	15000	43	0.67	7.79	555	0.83	Sparrows Point	289.57	68.07	5.76	5.59	10.98
		Main Engine - Maneuvering		3000	15000	43	0.67	7.79	555	0.4		139.55	32.80	2.78	2.69	5.29
		Auxiliary Engines - Transit		3000	3000	43	0.67	10.28	555	0.27		18.84	4.43	0.38	0.36	0.71
		Auxiliary Engines - Maneuvering	6	3000	3000	43	0.67	10.28	555	0.45		31.40	7.38	0.63	0.61	1.19
Preconstruction survey	Multi-role survey vessel	Main Engine - In Transit		392	784	7.6	0.20	14.50	664	0.83	Sparrows Point	15.13	3.56	0.30	0.29	0.57
		Main Engine - Maneuvering	2	392	784	7.6	0.20	14.50	664	0.4		7.29	1.71	0.15	0.14	0.28
		Auxiliary Engines - Transit		135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13
		Auxiliary Engines - Maneuvering	2	135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13
Cable termination and commissioning crew transfer vessel	Jack-up vessel	Main Engine - In Transit		2,350	4,700	43	0.60	6.55	879	0.83	Sparrows Point	90.73	21.33	1.81	1.75	3.44
		Main Engine - Maneuvering	2	2,350	4,700	43	0.60	6.55	879	0.20		21.86	5.14	0.44	0.42	0.83
		Auxiliary Engines - Transit		1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
		Auxiliary Engines - Maneuvering	2	1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15

Activity	Representative Vessel Type	Engine Type	Number of Engines	Individual Equipment Size (kW)	Total Equipment Size (kW)	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Exit Temperature (K)	Engine Load Factor (%)	Homeport During Project	NOx (lb/hr)	CO (lb/hr)	PM-10 (lb/hr)	PM-2.5 (lb/hr)	SO2 (lb/hr)
OCS Air Permit Emissions During Operations																
Scour Protection Repairs																
Scour protection repair	Fallpipe vessel	Main Engine - In Transit		4,500	13,500	33	1.01	5.13	555	0.83	Sparrows Point	260.61	61.26	5.19	5.03	9.88
		Main Engine - Maneuvering	3	4,500	13,500	33	1.01	5.13	555	0.40		125.60	29.52	2.50	2.42	4.76
		Auxiliary Engines - Transit		492	492	33	1.65	0.26	555	0.27		3.09	0.73	0.06	0.06	0.12
		Auxiliary Engines - Maneuvering	2	1200	1200	33	1.65	0.63	555	0.45		12.56	2.95	0.25	0.24	0.48
OSS O&M																
Refueling operations to OSS	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.20		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
WTG Inspection/ Maintenance /Repairs																
Main repair vessel	Jack-up vessel	Main Engine - In Transit		2,350	4,700	43	0.60	6.55	879	0.83	Sparrows Point	90.73	21.33	1.81	1.75	3.44
		Main Engine - Maneuvering	2	2,350	4,700	43	0.60	6.55	879	0.20		21.86	5.14	0.44	0.42	0.83
		Auxiliary Engines - Transit		1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
		Auxiliary Engines - Maneuvering	2	1,000	2,000	43	0.20	67.28	750	0.65		30.24	7.11	0.60	0.58	1.15
Gearbox oil change	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.20		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Ad hoc survey work	Multi-role survey vessel	Main Engine - In Transit		392	784	7.6	0.20	14.50	664	0.83	Sparrows Point	15.13	3.56	0.30	0.29	0.57
		Main Engine - Maneuvering	2	392	784	7.6	0.20	14.50	664	0.40		7.29	1.71	0.15	0.14	0.28
		Auxiliary Engines - Transit		135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13
		Auxiliary Engines - Maneuvering	2	135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13
Cable Inspection/Repairs																
Cable survey/inspections	Multi-role survey vessel	Main Engine - In Transit		392	784	7.6	0.20	14.50	664	0.83	Sparrows Point	15.13	3.56	0.30	0.29	0.57
		Main Engine - Maneuvering	2	392	784	7.6	0.20	14.50	664	0.40		7.29	1.71	0.15	0.14	0.28
		Auxiliary Engines - Transit		135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13
		Auxiliary Engines - Maneuvering	2	135	270	7.6	0.15	13.31	712	0.56		3.52	0.83	0.07	0.07	0.13
Daily O&M and Miscellaneous																
Daily crew transfer vessel	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.20		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Service operation vessel	Multipurpose offshore support vessel	Main Engine - In Transit		1,611	1,611	16	0.3	9.28	555	0.83	Sparrows Point	31.10	7.31	0.62	0.60	1.18
		Main Engine - Maneuvering	1	1,611	1,611	16	0.3	9.28	555	0.20		7.49	1.76	0.15	0.14	0.28
		Auxiliary Engines - Transit		123	246	16	0.15	9.46	555	0.56		3.20	0.75	0.06	0.06	0.12
		Auxiliary Engines - Maneuvering	2	123	246	16	0.15	9.46	555	0.56		3.20	0.75	0.06	0.06	0.12
Environmental monitoring Vessel	Crew transfer vessel	Main Engine - In Transit		749	1,498	6	0.46	2.29	555	0.83	Ocean City	28.92	6.80	0.58	0.56	1.10
		Main Engine - Maneuvering	2	749	1,498	6	0.46	2.29	555	0.20		6.97	1.64	0.14	0.13	0.26
		Auxiliary Engines - Transit		20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
		Auxiliary Engines - Maneuvering	2	20	40	6	0.06	8.86	555	0.56		0.52	0.12	0.01	0.01	0.02
Electrical Service Platform emergency generators	150 kW standard diesel generator	Engine	4	150	600	53	0.10	105.60	844	1.00	N/A	1.72	4.63	0.04	0.04	0.01

Source	NOx (g/kw-hr)	CO (g/kw-hr)	PM-10 (g/kw-hr)	PM-2.5 (g/kw-	SO_2 (g/kw-hr)
OCS Air Permit Emissions Factors					
Marine Diesel Engine	10.55	2.48	0.21	0.2036	0.40
Diesel Electric Generator	1.3	3.5	0.03	0.0291	0.006246

Notes:

1. Emissions for NOx, PM-2.5, and SO_2 based on BOEM Tool as provided in May 2022 US Wind Construction and Operations Plan (COP) and Project specific design criteria.

2. The BOEM Tool uses the latest EPA emission factors from the Ports Emissions Inventory Guidance/Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions Report (EPA 420-B-20-046, September 2020). The factors in Table A-1 for NOx, PM-2.5, and SO_2 are applied to all marine vessel types and engines (main propulsion engines or auxiliary engines)

3. Emission factors for CO and PM-10 were based on the latest EPA emission factors from the Ports Emissions Inventory Guidance/Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions Report (EPA 420-B-20-046, September 2020).

Appendix B
Meteorological Data Evaluation

Appendix B - Meteorological Data Evaluation
US Wind – Maryland Offshore Wind Project
Air Quality Modeling Protocol

Meteorological Data and Processing

This Appendix provides a description of the meteorological data extraction and processing steps for the Project, and provides a data representativeness comparison of:

1) onshore and offshore Weather Research and Forecasting (WRF) prognostic model data proposed to be utilized in the Project air dispersion analysis; with,
2) the available "observed" data for a representative onshore station in the region (Ocean City airport) and the offshore data from two (2) buoy stations.

Meteorological data for the air dispersion modeling, which will be performed using USEPA's AERCOARE-AERMOD model, were extracted from three consecutive years of WRF prognostic model data (2019 - 2021) obtained through USEPA Region 3 from USEPA's Office of Air Quality Planning and Standards (OAQPS). The Mesoscale Model Interface Program (MMIF - Version 4.0) was used to extract the necessary meteorological parameters at the points listed in Table 1. MMIF converts prognostic meteorological model output fields to the parameters and formats required for direct input into various dispersion models, including parameters required for USEPA's AERMOD (overland) and AERCOARE (overwater parameters) modeling systems. MMIF extracts the appropriate data for geographical points by determining which WRF data grid cell the point lies within, and then extracting data from that WRF grid cell. The WRF grid cells are spaced approximately 12 kilometers (km) apart, center to center.

Table 1 provides the geographical locations identified for the extraction of meteorological data for the AERCOARE-AERMOD modeling, and for the comparative analysis in this appendix. The "overwater extraction point for AERCOARE-AERMOD modeling" corresponds to the centroid of the Project. The other points shown in the table correspond to the overwater and overland points used for the data comparison discussed in the meteorological representativeness section, as well as the WRF extraction grid points. The overwater extraction point corresponds to the location of the Delaware Bay 26 NM buoy (Buoy #44009), such that a comparison can be made with the observations from that station. The overland station point is the Ocean City Airport (KOXB) Station number 93786. The airport data were obtained from the National Centers for Environmental Information (https://gis.ncdc.noaa.gov/maps/ncei).

Data for the overwater points were extracted using the AERCOARE option in MMIF, which extracts parameters required by AERCOARE for overwater dispersion. The overland points were extracted using the AERMET option, which extracts parameters required for the AERMOD overland meteorological files and allows for the comparison of observed (OBS) and WRF-extracted data as presented in the meteorological representativeness section.

Table 1. Meteorological Extraction Points and WRF Grid Point Locations.

Data	Latitude	Longitude	Comment
Overwater extraction point for AERCOARE/AERMOD Modeling	38.3467	-74.7605	Corresponds to the Project Centroid
Delaware Bay 26 NM Buoy for overwater meteorology	38.460	-74.692	~14 km northeast of Project Centroid
Ocean City Inlet Buoy for overwater meteorology	38.328	-75.091	~29 km west of Project Centroid
Ocean City Airport for overland surface meteorology comparison	38.309	-75.123	~32 km west of Project Centroid
WRF data location for overland meteorology comparison	38.327	-75.140	Nearest WRF node to Ocean City Airport surface station
WRF data location for overwater meteorology comparison	38.460	-74.671	Nearest WRF node to Delaware Bay 26 NM Buoy
WRF data location for AERCOARE/AERMOD Modeling	38.354	-74.704	Nearest WRF node to Project Centroid

Figure 1 displays an overview of the following locations:

1) MMIF extraction points for WRF data
2) Buoy data locations for meteorological data comparison
3) Project Centroid

The Delaware Bay 26 NM buoy (Buoy #44009) was chosen for the observations comparison, as it is located in proximity to the Project work area to be used for the study. The buoy data was downloaded directly from the National Oceanic and Atmospheric Administration's (NOAA's) National Data Buoy Center website. The buoy records hourly wind speed and wind direction data at a height of 3.8 meters above sea level (msl). The data completeness of the parameters over the 3-year period used (2019-2021) is 38.1 to 64.3 percent for both wind speed and wind direction. The quarterly completeness ranged from 0% to 99.9%.

Due to the poor annual and quarterly completeness of the Delaware Bay buoy data, and because wind data are the most important parameters used for dispersion modeling, the Ocean City Inlet buoy data was also used for the comparison. The Ocean City inlet buoy data completeness of the parameters over the 3-year period used (2019-2021) is 89.9% to 97.0% for both wind speed and wind direction. The quarterly completeness ranged from 75.3% to 99.9%.

The Ocean City Airport (KOXB, Station No. 93786) was selected as the overland site for comparison to the extracted WRF data. This station is located 32 km west of the Project Centroid and contained all parameters required to process an AERMET meteorological file.

The following overwater parameters were obtained or calculated as described below:

- Humidity – Missing for Delaware Bay 26 NM buoy and Ocean City Inlet buoy; therefore, the default value from the OCD users guide was used
- Overwater surface and ambient air temperature – Monitored data by Delaware Bay 26 NM buoy and Ocean City Inlet buoy

The model also can accept wind direction and speed, wind shear, turbulence intensities, and temperature gradients, if available.

The following overland meteorological parameters were obtained or calculated as described below:

- Wind speed and wind direction – Monitored by KOXB
- Ambient air temperature – Monitored by KOXB

Figure 1. Locations of MMIF Model Extraction Points for AERCOARE/AERMOD Modeling, Buoy and Surface Observations, and WRF Nodes for Meteorology Comparison

Meteorological Data Representativeness Comparison

Comparison of Observed Meteorological Data to Weather Research and Forecasting Data

Comparisons between observed (OBS) meteorological data and those extracted from the WRF data set were performed, and the results are discussed in this section.

Figures and tables associated with the data comparison assessment are also presented in this section. The comparisons were developed consistent with the USEPA guidance document, *Evaluation of Prognostic Meteorological Data in AERMOD Applications* (USEPA, 2018).

Wind Roses

Wind roses for the OBS and WRF data sets for the overland locations are presented in Figure 1. Likewise, the wind roses for the OBS and WRF data sets for the overwater locations are presented in Figure 2 and Figure 3. The wind rose for the WRF data set for the Project centroid is provided in Figure 4.

The overwater and overland wind roses both exhibit strong component from the southwest and north-northwest for all cases. Overall, the agreement between the WRF data and buoy data for the overwater location is very good, with both the direction and frequency of winds from various directions in agreement.

The good agreement between the wind direction and wind speed data as shown by the wind roses indicates that the WRF data set provides representative model results when used within the AERMOD model.

Comparison of Primary and Calculated Meteorological Parameters

Table 2 presents a statistical comparison of the WRF versus OBS data sets for the onshore WRF data versus onshore observational data. Likewise, Tables 3 through 4 present a statistical comparison of the WRF versus OBS data sets for the offshore WRF data versus offshore observational data. Tables 2 through 4 list statistics for several primary variables, including wind direction and speed, temperature, and pressure. The tables also list calculated statistics for heat flux and surface friction velocity.

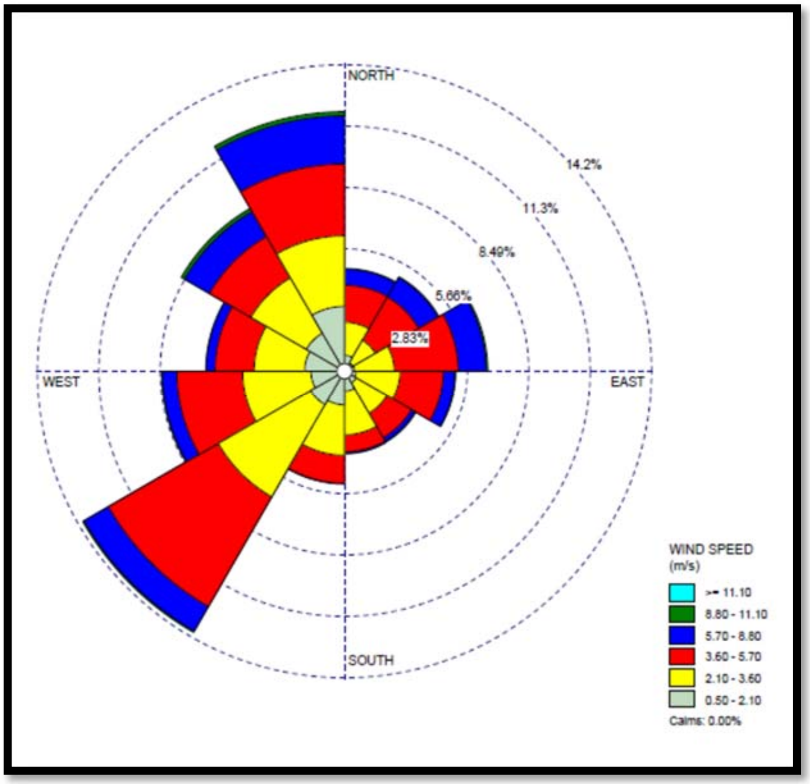
Missing OBS data were not used in any of the statistical comparisons, and the corresponding hours from the WRF data were omitted. From Tables 2 through 4, findings include:

- There is a small positive mean bias in the wind speeds, meaning observed wind speeds are slightly higher for the WRF data set than the OBS data set. Although wind speeds are slightly overpredicted by WRF, the wind directions as shown in the wind roses are in good agreement.
- WRF data tend to slightly overpredict temperature when compared to their respective observed counterparts. The differences, however, are minor. For example, mean temperature bias is less than 0.8 degree Celsius (°C).

- WRF scenarios tended to have slightly higher values than the observed scenarios for the surface friction velocity. The differences are minor, with a mean bias less than 0.1 m/s.

Overall, while there are differences, the WRF data show good agreement with the OBS data. Wind roses for the overland and overwater data are in good agreement. Primary meteorological parameters such as wind direction, wind speed, pressure, and ambient temperatures tend to show high confidence of agreement. The similarities between the two data sets in the various primary and calculated meteorological parameters imply that using the WRF data is appropriate for this dispersion modeling study and should provide reliable results.

Observed Wind Data – Ocean City Airport



WRF Wind Data – Ocean City Airport

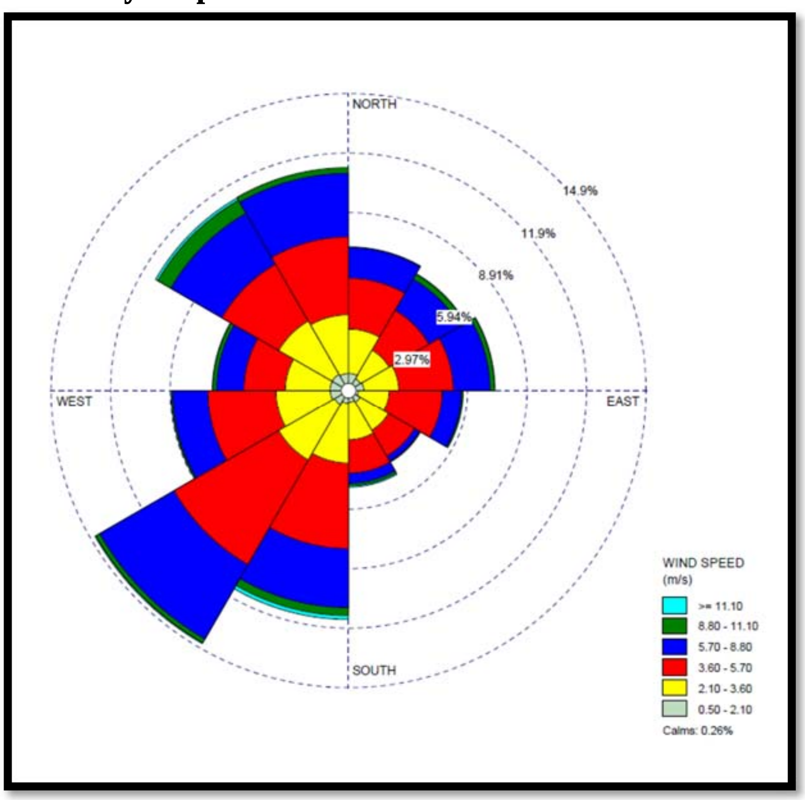
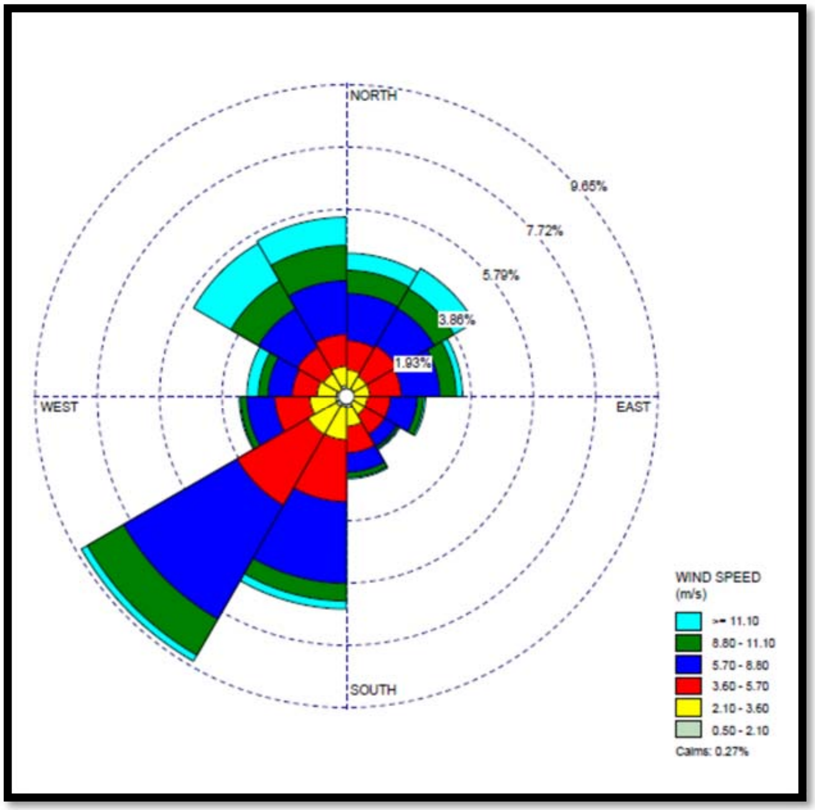


Figure 1. Onshore Data - Comparison of Observed and WRF Annual Wind Roses

Observed Wind Data – Delaware Bay Buoy (44009)



WRF Wind Data – Delaware Bay Buoy (44009)

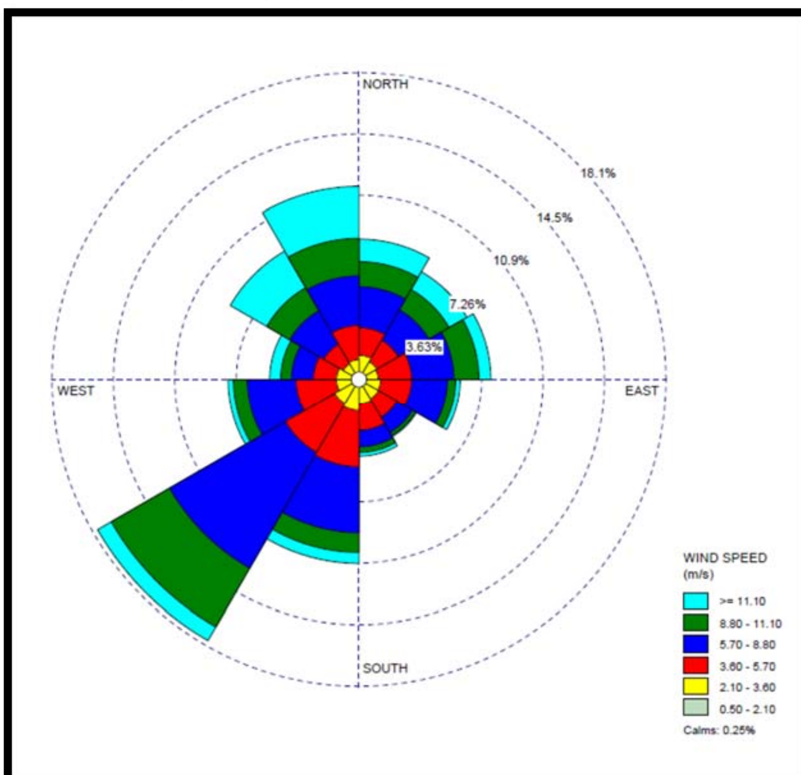
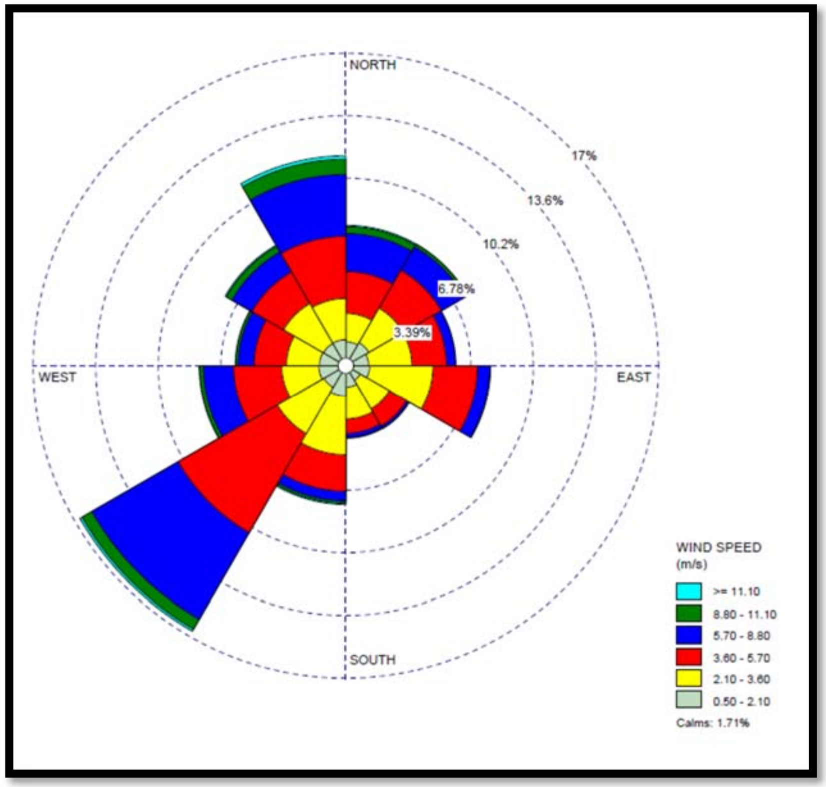


Figure 2. Offshore Data - Comparison of Observed and WRF Annual Wind Roses

Observed Wind Data – Ocean City Inlet Buoy



WRF Wind Data – Delaware Bay Buoy (44009)

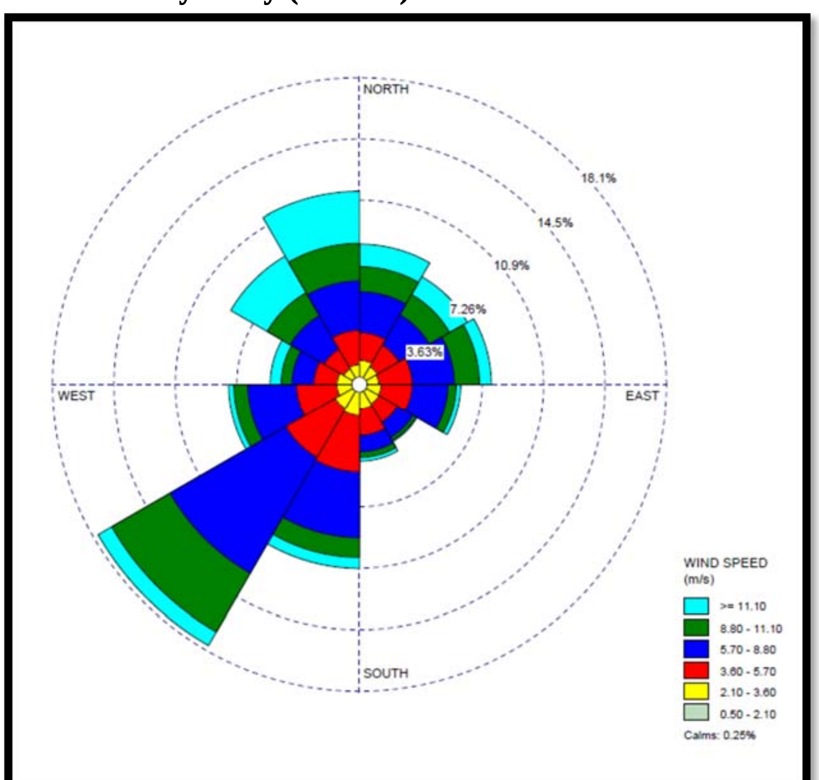


Figure 3. Offshore Data - Comparison of Observed and WRF Annual Wind Roses

WRF Wind Data – US Wind Project Centroid

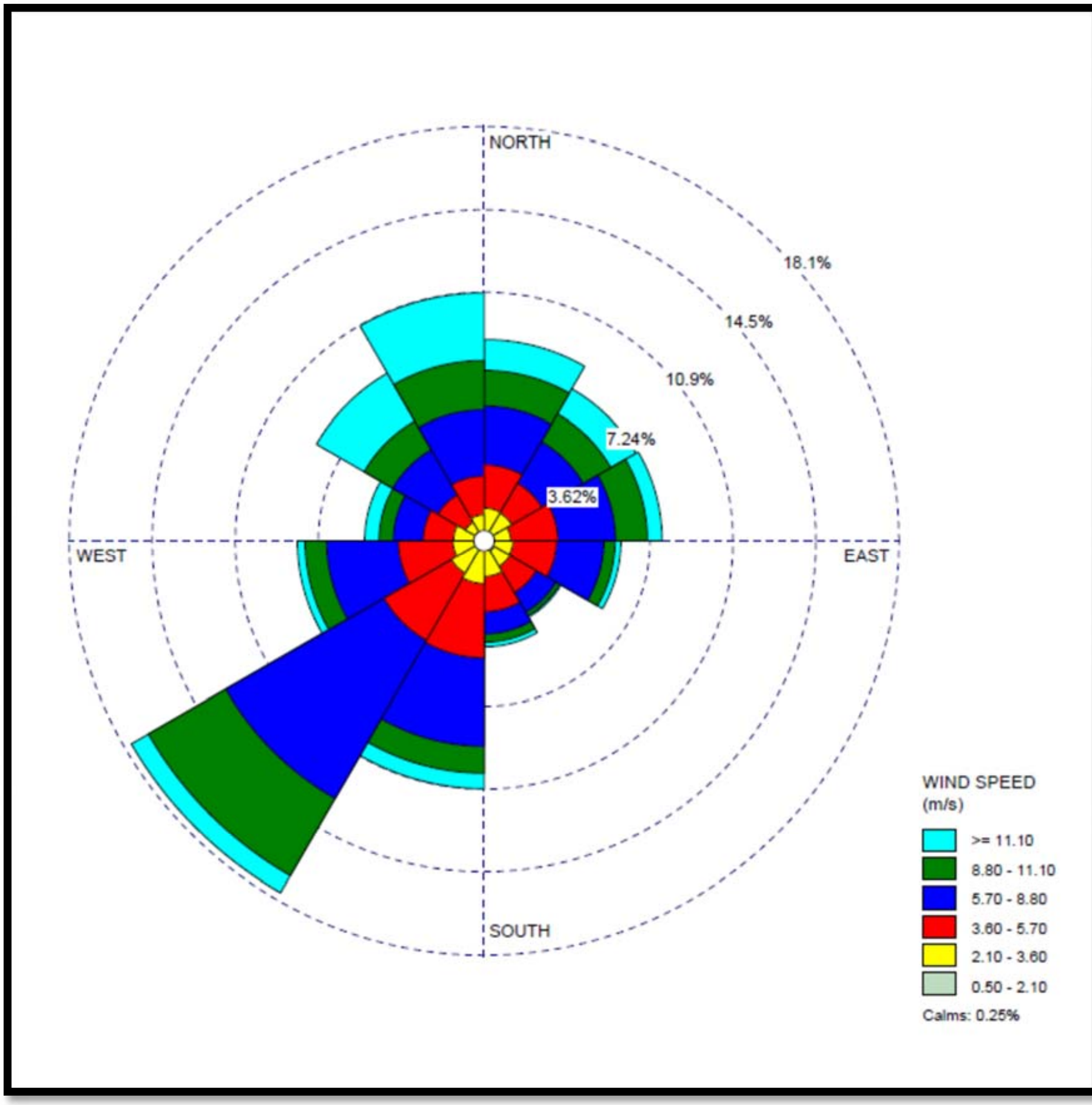


Figure 4. Offshore Data - WRF Wind Rose for Project Centroid

Table 2. Mean Bias, Fractional Bias, Root Mean Square Error, and R^2 for Onshore Primary Meteorological Variables (WRF-OBS)

Variable	Mean Bias	Fractional Bias	RMSE	R^2
Wind Direction (degrees)	-2.05	0.0032	85.43	0.41
Wind Speed (m/s)	0.62	0.1529	1.59	0.50
Ambient Temperature (K)	0.75	0.0026	4.77	0.82
Pressure (mb)	-0.28	-0.0003	3.74	0.75
Heat Flux (W/m^2)	6.87	-0.1510	45.41	0.75
Surface Friction Velocity (m/s)	0.06	0.1253	0.18	0.53

Table 3. Mean Bias, Fractional Bias, Root Mean Square Error, and R^2 for Offshore Primary Meteorological Variables (WRF-OBS) – Delaware Bay Buoy (44009)

Variable	Mean Bias	Fractional Bias	RMSE	R^2
Wind Direction (degrees)	-1.93	0.0304	60.75	0.45
Wind Speed (m/s)	0.65	0.1111	1.33	0.74
Ambient Temperature (K)	0.60	0.0021	1.79	0.98
Pressure (mb)	2.20	0.0022	5.70	0.90
Heat Flux (W/m^2)	-8.02	-0.2257	16.05	0.79
Surface Friction Velocity (m/s)	0.00	-0.0007	0.05	0.75

Table 4. Mean Bias, Fractional Bias, Root Mean Square Error, and R^2 for Offshore Primary Meteorological Variables (WRF-OBS) – Ocean City Inlet Buoy

Variable	Mean Bias	Fractional Bias	RMSE	R^2
Wind Direction (degrees)	3.92	0.0196	94.70	0.33
Wind Speed (m/s)	2.82	0.5201	3.70	0.43
Ambient Temperature (K)	0.61	0.0022	3.75	0.78
Pressure (mb)	-0.79	-0.0008	3.52	0.78
Heat Flux (W/m^2)	5.45	0.1918	28.27	0.52
Surface Friction Velocity (m/s)	0.11	0.5266	0.14	0.45

Notes: Formulas for mean and fractional bias are:

$$Mean\ Bias = \frac{1}{n}\sum_{1}^{n}(WRF - Observed)$$

$$Fractional\ Bias = \frac{2}{n}\sum_{i=1}^{n}\frac{(WRF_i - Observed_i)}{(WRF_i + Observed_i)}$$

August 8, 2023

Ms. Suna Y. Sariscak
Manager, Air Quality Permits Program
suna.sariscak@maryland.gov
Maryland Department of the Environment
1800 Washington Blvd.
Baltimore, MD 21230

Re: US Wind, Inc Responses to MDE Comments on Maryland Offshore Wind Project Air Dispersion Modeling Protocol (July 25, 2023)

Dear Ms. Sariscak:

US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project (the Project), an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within the area described in OCS-A 0490 (the Lease), a Lease area of approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10.0 nautical miles [nm]) off the coast of Maryland on the outer continental shelf (OCS). The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease area. The Project will be interconnected to the onshore electric grid by up to four (4) new 230-275 kV export cables into new onshore substations in Delaware. US Wind is required by the OCS Air Regulations in 40 Code of Federal Regulations (CFR) Part 55.4, to obtain an air permit for the proposed construction and operation and maintenance (O&M) of the Project.

In accordance with the United States Environmental Protection Agency's (EPA) Outer Continental Shelf (OCS) air regulations (40 CFR Part 55) and the Prevention of Significant Deterioration (PSD) permitting regulations (40 CFR Part 52.21), the Project is preparing an ambient air impact analysis. US Wind is providing the attached response to comments that address MDE comments received on July 27, 2023, for the review of the Revised Air Quality Modeling Protocol (March 2023).

Please contact me at 410-340-9428 or l.jodziewicz@uswindinc.com if you have any questions regarding these responses.

Sincerely,

Laurie Jodziewicz
Senior Director of Environmental Affairs
US Wind, Inc.

Attachment: US Wind – Maryland Offshore Wind Project: Responses to MDE comments on Revised Air Quality Modeling Protocol cc:

Ms. LiAn Zhuang
Air Quality Modeler, Modeling and Analysis Division
1800 Washington Blvd.
Baltimore, MD 21230
Email: lian.zhuang@maryland.gov

US Wind, Inc Responses to MDE Comments to Maryland Offshore Wind Project Air Dispersion Modeling Protocol (July 25, 2023)

Comment 1 - Temporary emissions exemption:

USEPA considers construction sources operating for no longer than two years to be temporary sources for PSD permitting purposes. Is US Wind planning to claim the PSD temporary emission exemption for the construction period (proposed construction period is 4 years)?

Response:
US Wind is not claiming the construction period to be temporary emission sources for the purposes of PSD permitting. The construction period emissions will be addressed in the OCS air permit application and included in the air quality modeling analysis.

Comment 2 - Inconsistencies of emission rates between the modeling protocol and Class I area AQRV exemption request:

The maximum annual emissions provided in the Class I area AQRV exemption request dated June 16, 2023 are significantly lower than that in the modeling protocol. Please confirm if the emissions have been updated since the preparation of the modeling protocol. Please note if this request is not approved, additional long range modeling will be required.

Response:
As discussed in Section 2.0 of the Air Quality Modeling Protocol, the maximum annual emissions were preliminary and would be updated within the OCS air permit application. The emissions rates provided in the Air Quality Modeling Protocol are conservative as they are based on Bureau of Ocean Energy Management (BOEM) Tool default emission factors and operational assumptions. The OCS air permit application will include revised emissions calculations, which are based on the results of the required control technology assessment and refined operational details.

Comment 3 - Section 2.2 - Modeling Methodology:

It is proposed to use the peak month and peak year of construction to capture all of the activities of emissions. It is not clear if and how the peak month approach will be utilized in modeling. Please provide more details, specifically,

- Please provide the methodology of how the peak month will be selected.
- It is not very clear if the maximum hourly emission rates will be used for worst case impact for all averaging periods. Please specify if the peak month (assumed to be worst case) emissions will be input to the model throughout the year. Please also provide more details

of what emission rates will be used for each averaging period. If variable emission rates will be used, please provide details.

Response:
Nearly all construction, commissioning, and O&M activities will take place for only a few hours or days at any one WTG or OSS position, and most emissions sources will be in-motion. The timing and order of the O&M activities will not be in a set pattern, and the schedule will change regularly based on weather conditions. Each construction activity will happen for a single stretch of time, which for activities such as foundation installation is a few days or less. Construction activities at any one position will be scheduled based on the weather and based on shifting logistics for the entire construction effort. Generally, groups of vessels will work together to perform discrete activities such as WTG installation, scour protection, etc. As such, there is a temporally and spatially varying aspect to be considered. Because construction activity is expected to occur over a 4-year period, and numerous individual vessel activities would occur over this time period, the short-term (i.e., 1-hour, 3-hour, 8-hour, and 24-hour) and annual construction activities that result in maximum air emissions will be modeled for comparison to NAAQS and PSD increments. With this modeling methodology, any combination of construction activities in a given time period that would result in lower emissions would have less of an air quality impact than from the maximum emissions scenarios. As such, it is not necessary to assess the peak month of potential construction emissions.

The maximum hourly emission rates will be utilized for modeling the 1-hour averaging period. For averaging periods longer than 1-hour, the maximum source operation time for any given mode of operation and construction or O&M activity will be modeled using the maximum hourly emissions rate that is scaled by the number of hours that source could be in operation by the number of hours in the averaging period. For example, if a vessel engine may be operated for up to 1,000 hours per year to construct the WTGs, the annual averaging period emission rate would be determined by scaling the maximum hourly emission rate by 1,000/8,760. The OCS air permit application will provide a detailed discussion and matrix of modeled emission rates by pollutant and averaging period for each vessel engine, operating mode, and construction or O&M activity.

The proposed peak year of construction and commissioning, corresponding to the maximum annual potential to emit, captures all of the activities that could potentially occur within the 25 NM OCS area and as such, will be included in the annual modeling analyses as the worst-case emissions scenario. For the peak year of construction, commissioning (including any overlapping O&M), the following activities may be taking place in various areas of the WDA simultaneously:

- Monopile (MP) Foundation Installation;
- Scour protection installation;
- WTG Installation;
- WTG Commissioning;
- OSS Installation;
- OSS Commissioning;
- Inter-Array Cable Installation;
- Offshore Export Cable Installation; and
- Overlapping O&M activities.

O&M phase emissions would consist of the following activities:

- Vessel transit within the OCS area;
- Onsite maneuvering at the WTGs and OSSs; and
- Onsite diesel generators.

Comment 4 - Section 2.2, Modeling Methodology - Page 2-8 and Table 2-3:

It is proposed, for simplification of the modeling, to assume that all activities occur at the same location for the entire modeled period. Please provide more details of where the location of activities will be, as well as demonstration that this location will have the worst case impact. In Table 2-3, it is proposed that all point sources will be located at centroid of OCS area, which may or may not be the worst case impact location.

Response:
The Project construction and O&M emission activities will occur within an area of approximately 80,000 acres located approximately 18.5 km off the coast of Maryland on OCS. The activities will be focused within the 80,000 acre area for construction and O&M of up to 121 WTGs, up to four (4) OSS, and one (1) meteorological tower. The Project would be interconnected to the onshore electric grid by up to four (4) new 230-275 kV export cables into new onshore substations in Delaware. Figure 1 provides a map that shows the location of the 80,000 acre Lease area and the 25 NM distance from the Project centroid (i.e., the 25 NM OCS area).

Activities would occur throughout the 25 NM OCS area and will be transient. For example, the monopile foundation installation would occur over the course of two days for a specific WTG location. Then, the group of ships responsible for the monopile installation would move to the next WTG position and begin installation of another monopile. For simplification of the modeling given this spatial and temporal uncertainty regarding vessel locations, the modeling was conducted based on the conservative assumption that these activities occur at the same location for the entire modeled period.

The OCS air permit application will provide a detailed modeling assessment based on the assumption that all of the construction and O&M activities occur at the centroid of the OCS area. The location of maximum modeled impacts will be demonstrated within the OCS air permit application to occur within 1 km of the construction and O&M activity for all modeled pollutants and averaging periods. Because the OCS has a uniform elevation of zero meters and given a polar receptor grid, any modeled location of vessel activities at a single WTG or OSS would result in identical maximum modeled short term concentrations. For annual construction modeling, the majority of the vessel emissions would occur over the 80,000 acre lease area and would be transient while all of the emissions would occur within the 25 NM OCS area (i.e., 1.66 million acres). Assuming that all of the activities would occur at the location of the Project centroid is very conservative considering that the annual emissions would otherwise be spread over an area of 1.66 million acres.

Comment 5 – Section 2.3.1 - Source Characterization:

Please specify if multiple line sources representing the Line 1 – supply route and Line 2 – Offshore

Export Cable Installation will be modeled as simultaneously operating emission sources.

Response:
The OCS air permit application will provide a detailed description and matrix of sources that are assumed to occur simultaneously for both transiting and maneuvering vessels. For simplification of short-term and annual modeling, the location of the Line 1 and Line 2 sources were assumed to be collocated. Additionally, as a simplifying conservative assumption, annual modeling assumes that all of the vessel supply and cable construction emissions are collocated and will occur simultaneously with the location and occurrence of the WTG and OSS construction and overlapping O&M. Refer to the Comment 4 response for additional details regarding the annual modeling period.

Comment 6 - Good Engineering Practice Stack Height:

It is proposed to use a typical design value of 50 m as the OSS platform height. Please ensure that this will have the worst case impact compared to other values of platform height.

Response:
The OCS air permit application will provide results of the air quality modeling assessment for the worst-case impact from OSS platform heights ranging from 50 m to 60 m.

Comment 7 - Section 3.0 Regulatory Requirements:

Table 3-3:

- For this modeling analysis, the modeled concentrations should be averaged over 3 years because the 3-year prognostic meteorological data will be used.

- Please verify the PSD Class II SIL for 1-hour NO_2. The EPA, June 29, 2010, guidance document "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program" recommends an interim SIL value of 4 ppb (or 7.5 $\mu g/m^3$).

Table 3-4:

Please also include values for PSD Class I increments in the table since the PSD Class I increment analysis will be conducted.

Response:
The OCS air permit application will provide a table of the PSD Class I and II significant impact levels with the appropriate references to a 3-year averaging period. The PSD Class II SIL for 1-hour NO_2 has not been proposed by USEPA such that the interim SIL value of 4 ppb is applicable.

The OCS air permit application will provide a table of PSD Class I increments.

Comment 8 – Section 4.3 - AERMOD Model Options:

Please note that MDE may request use of the latest version of AERMOD that will be released in the fall of 2023.

Response:
US Wind understands that the USEPA is planning to provide an update to the AERMOD dispersion model in October 2023. As such, US Wind will prepare and submit the OCS air permit application based on the current version of the AERMOD model. If requested by MDE, US Wind will provide a supplemental air quality modeling analysis after the AERMOD model update is released.

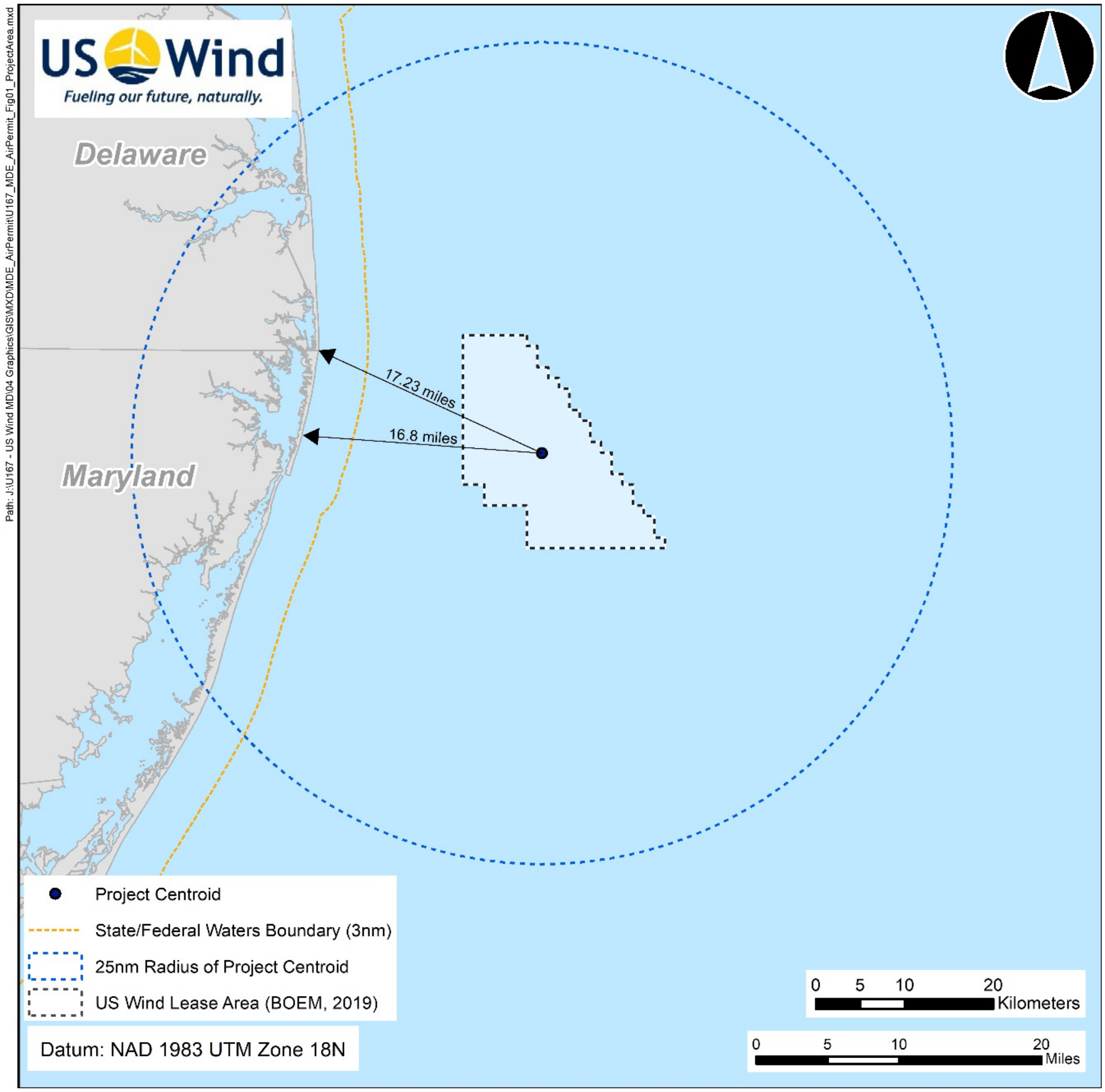
Comment 9 - Section 4.4 - Receptor Grid:

Similar to the previous comment on Section 2.2, please ensure that the receptor grid will capture the worst case impact, given the spatial variability of the emission sources. Please specify whether a single polar receptor grid centered at the centroid of OCS area will be used, or if multiple/varying receptor grids will be used, depending on the locations of emission sources.

Response:
For NAAQS and PSD Class II modeling, a single polar grid of receptors will be utilized. It should be noted that the receptors are nearly entirely over water, in locations where there are no residences, and where the public is unlikely to remain for any extended period of time.

The location of maximum modeled impacts will be demonstrated within the OCS air permit application to occur within 1 km of the construction and O&M activity for all modeled pollutants and averaging periods. Because the OCS has a uniform elevation of zero meters and given the assumption that vessel activities regardless of where they would actually occur, are centered at the centroid of the OCS, any modeled location of vessel activities at a single WTG or OSS would result in identical maximum modeled concentrations assuming the centroid and receptor spacing remain identical. Thus, the modeling analysis will be based on a single polar receptor grid that is centered at the centroid of the OCS area for all pollutants and averaging periods.

Figure 1: Distances to Corresponding Onshore Area



Maryland Department of the Environment
Comments to Maryland Offshore Wind Project
Air Dispersion Modeling Protocol
July 2023

The following comments are provided to the US Wind Maryland Offshore Wind Project Air Quality Modeling Protocol that was initially dated September 2022 and revised March 2023. Please note that additional questions and comments will very likely arise after the permit application is submitted and reviewed.

General questions:

- Temporary emissions exemption:

US EPA considers construction sources operating for no longer than two years to be temporary sources for PSD permitting purposes. Is US Wind planning to claim the PSD temporary emission exemption for the construction period (proposed construction period is 4 years)?

- Inconsistencies of emission rates between the modeling protocol and Class I area AQRV exemption request:

The maximum annual emissions provided in the Class I area AQRV exemption request dated June 16, 2023 are significantly lower than that in the modeling protocol. Please confirm if the emissions have been updated since the preparation of the modeling protocol. Please note if this request is not approved, additional long range modeling will be required.

Section 2.2 Modeling Methodology

- Page 2-8:

It is proposed to use the peak month and peak year of construction to capture all of the activities of emissions. It is not clear if and how the peak month approach will be utilized in modeling. Please provide more details, specifically,

a. Please provide the methodology of how the peak month will be selected.
b. It is not very clear if the maximum hourly emission rates will be used for worst case impact for all averaging periods. Please specify if the peak month (assumed to be worst case) emissions will be input to the model throughout the year. Please also provide more details of what emission rates will be used for each averaging period. If variable emission rates will be used, please provide details.

- Page 2-8 and Table 2-3:

It is proposed, for simplification of the modeling, to assume that all activities occur at the same location for the entire modeled period. Please provide more details of where the location of activities will be, as well as demonstration that this location will have the worst case impact. In Table 2-3, it is proposed that all point sources will be located at centroid of OCS area, which may or may not be the worst case impact location.

2.3.1 Source Characterization

- Please specify if multiple line sources representing the Line 1 – supply route and Line 2 – Offshore Export Cable Installation will be modeled as simultaneously operating emission sources.

2.4 Good Engineering Practice Stack Height

- It is proposed to use a typical design value of 50 m as the OSS platform height. Please ensure that this will have the worst case impact compared to other values of platform height.

Section 3.0 Regulatory Requirements

- Table 3-3:
    a. For this modeling analysis, the modeled concentrations should be averaged over 3 years because the 3-year prognostic meteorological data will be used.

    b. Please verify the PSD Class II SIL for 1-hour NO_2. The EPA, June 29, 2010, guidance document "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program" recommends an interim SIL value of 4 ppb (or 7.5 µg/m^3).

- Table 3-4: Please also include values for PSD Class I increments in the table since the PSD Class I increment analysis will be conducted.

Section 4.3 AERMOD Model Options

- Please note that MDE may request use of the latest version of AERMOD that will be released in the fall of 2023.

Section 4.4 Receptor Grid

- Similar to the previous comment on Section 2.2, please ensure that the receptor grid will capture the worst case impact, given the spatial variability of the emission sources.

Please specify whether a single polar receptor grid centered at the centroid of OCS area will be used, or if multiple/varying receptor grids will be used, depending on the locations of emission sources.

SENT VIA E-MAIL CORRESPONDENCE

December 27, 2022

Ms. Laurie Jodziewicz
US Wind, Inc.
Senior Director of Environmental Affairs
401 East Pratt Street, Suite 1810
Baltimore, MD 21202

Re: Preliminary comments to the Maryland Offshore Wind Project Air Quality Modeling Protocol

Dear Ms. Jodziewicz:

On September 28, 2022, the Maryland Department of the Environment (MDE) received a request from US Wind, Inc. for the approval to an Air Quality Modeling Protocol (Protocol). US Wind intends to construct and operate the Maryland Offshore Wind Project (Wind Project) in a Lease Area (~ 80,000 acres) located 18.5 km (11.5 miles, 10.0 nautical miles off the coast of Maryland on the outer continental shelf (OCS).

The Air Quality Monitoring Program (AQMP) has performed a preliminary review of the contents described in the Protocol. This letter summarizes AQMP's initial comments on the Protocol, dated September 2022. The Protocol is one of the supporting documents for the approvals.

The Protocol specifically addresses the construction and O&M phases of the Wind Project and defines the sources to be modeled, provides preliminary emissions estimates, and describes the modeling methodologies for the project's air quality impact assessments. The protocol was prepared on your behalf by TRC Environmental Corporation 1099 Wall Street West, Suite 250B Lyndhurst, New Jersey 07071. More detailed information about the Wind Project is included with Protocol.

At this time, MDE comments are mainly focused on Section 4.0 of the Protocol - modeling methodology. Once the concerns raised are resolved, MDE may have further comments at the appropriate and later time. Included below are more specific comments:

- Section 4.1 - Model Selection
  It is understood that the Offshore and Coastal Dispersion Model (OCD v.5) is the EPA preferred/recommended model for overwater sources, as specified in the Guideline on Air Quality Models (aka Appendix W). However, as mentioned in the modeling protocol, OCD has certain limitations when compared to the alternative AERCOARE-AERMOD combination. As listed in the modeling protocol, each model has its own advantages and disadvantages, as clearly stated in Section 4.1.

  After discussion with EPA and based on recent OCS project approvals, it is highly recommended to use the alternative AERCOARE-AERMOD combination. EPA's modeling clearinghouse (https://cfpub.epa.gov/oarweb/MCHISRS/) now contains seven approved alternative model requests and approvals (four in Region 1, two in Region 2, and one in Region 3) for the AERCOARE-AERMOD application on outer continental shelf air permitting. MDE highly recommends US Wind to review these requests.

The approval process for the use of the alternative model starts with a consultation with EPA Region 3. It is also recommended to consult 40 CFR Appendix W to Part 51 - Guideline on Air Quality Models for more detail information about the approval process of alternative models.

Please note that the approval process of an alternative model request takes time. Therefore, if considering such an approach, the request should be submitted in a timely manner to avoid any potential delays in permitting.

- Section 4.2 - Meteorological Data
  The Protocol states the intention of using observed surface and upper air meteorological data. Recent similar modeling studies have used prognostic meteorological data. In a revised protocol, please provide a detailed analysis comparing these two types of data. The comparison should include both overland and overwater portions. Based on this analysis, a decision could be made about which type of meteorological data should be used.

- Section 4.9 - Ozone and PM2.5 Attainment Issues
  In a revised protocol, please include plans for demonstrating compliance with ozone NAAQS and PM2.5 PSD increments through modeling. Please refer to the most recent EPA guidance document “Guidance for Ozone and Fine Particulate Matter Permit Modeling” (July 29, 2022) as well as “Photochemical Model Estimated Relationships Between Offshore Wind Energy Project Precursor Emissions and Downwind Air Quality (O3 and PM2.5) Impacts” (November 2022, attached to this email).

In summary and as the next step, the Department would recommend contacting EPA Region 3, to start the approval process for the use of the alternative model, as suggested earlier. The Department will work and support you through this process prior to the submittal of a revised and final protocol. If you have any questions regarding this letter, please contact me at (410) 537-4129 or suna.sariscak@maryland.gov.

Sincerely,

Suna Yi Sariscak

Suna Yi Sariscak, Manager
Air Quality Permits Program
Air and Radiation Administration

cc:
Ryan Auvil, Manager, Air Quality Monitoring Program
LiAn Zhuang, Air Quality Modeler, Modeling and Analysis Division, Air Quality Monitoring Program
Mario Cora, Senior Regulatory and Compliance Engineer, Air Quality Permits Program

B-4
Federal Land Manager Class I AQRV Exemption Request Letter

TRC
41 Spring St., Suite 102
New Providence, NJ 07974
T 908.988.1700
TRCcompanies.com

June 16, 2023

Ms. Jill Webster
Environmental Scientist
United States Department of the Interior
U.S. Fish & Wildlife Service
National Wildlife Refuge System
7333 W. Jefferson Ave., Suite 375
Lakewood, Colorado 80235-2017

**Subject: Maryland Offshore Wind Project – US Wind, Inc.
Request for Determination for Need for Class I Area Air Quality and Air Quality Related Values (AQRV) Analyses for the Brigantine Wilderness Class I Area**

Dear Ms. Webster:

US Wind, Inc. (US Wind) is developing the Maryland Offshore Wind Project (the Project), an offshore wind energy project of up to approximately 2 gigawatts (GW) of nameplate capacity within the area described in OCS-A 0490 (the Lease), a Lease area of approximately 80,000 acres located approximately 18.5 km (11.5 miles, 10.0 nautical miles [nm]) off the coast of Maryland on the outer continental shelf (OCS). The Project Design Envelope (PDE) includes up to 121 wind turbine generators (WTG), up to four (4) offshore substations (OSS), and one (1) meteorological tower (Met Tower) located in the Lease area. The Project will be interconnected to the onshore electric grid by up to four (4) new 230-275 kV export cables into new onshore substations in Delaware. US Wind is required by the OCS Air Regulations in 40 Code of Federal Regulations (CFR) Part 55.4, to obtain an air permit for the proposed construction and operation and maintenance (O&M) of the Project.

In accordance with the United States Environmental Protection Agency's (EPA) Outer Continental Shelf (OCS) air regulations (40 CFR Part 55) and the Prevention of Significant Deterioration (PSD) permitting regulations (40 CFR Part 52.21), the Project is required to perform an ambient air impact analysis.

The generation of offshore wind energy itself does not emit air contaminants. However, there would be air emissions associated with vessel engines and other equipment involved in the construction and operation and maintenance of the Project. US Wind is subject to PSD permitting and is required to submit an OCS Air Permit application that includes a dispersion modeling demonstration that air emissions from the Project would not cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS) or PSD increments. Additionally, there is one (1) Class I area within 300 km of the Project, the Brigantine Wilderness area located in the Edwin B. Forsythe National Wildlife Refuge (NWR) in New Jersey, which is located approximately 126 kilometers north-northeast of the Project. As such, the Project may be subject to a Class I area air quality and air quality related values (AQRV) analyses.

Estimated potential maximum annual emissions are presented in Table 1. The PM-10 emission rates presented in Table 1 include filterable and condensable particulates.

Table 1: Estimated Potential Emissions

Pollutant	Maximum Construction and Commissioning Annual Emissions[1] (tpy)	Full Project Operation Annual Emissions[2] (tpy)
Nitrogen Oxides (NO_x)	536.8	25.1
Sulfur Dioxide (SO_2)	1.9	0.07
Particulate Matter with an aerodynamic diameter less than 10 microns (PM-10)	17.7	0.7
Sulfuric Acid Mist (H_2SO_4)	0.1	0.003

[1]Annual emissions represent the maximum emissions during the construction and commissioning period, including any potential overlapping emissions from O&M.
[2]Annual emissions based on operation and maintenance for full Project operation (i.e., 121 WTGs).

The Brigantine Wilderness Class I area located in the Edwin B. Forsythe National Wildlife Refuge in New Jersey is approximately 126 km north-northeast of the proposed Project. Following the Draft Revised FLAG guidance (2010), US Wind believes that the proposed Project is eligible for an exemption from the requirement to perform a Class I area AQRV modeling analysis because of its low emissions and distance to the Class I area. Using the maximum emissions from the construction/commissioning period, yields a (emission in tpy)/(distance in km) ratio (556.5 tons per year/126 km) of approximately 4.4. Using the maximum emissions from the O&M period for the full Project operation, yields a Q/D of only 0.2.

It is our understanding that according to the Q/D test, the FLM should consider this source (which is located greater than 126 km from the Brigantine Wilderness Class I area) and has a ratio of annual equivalent emissions (Q in tons per year) divided by distance (D in km) from the Brigantine Wilderness Class I area (km) < 10, as having negligible impacts with respect to Class I visibility impacts and that there would not be any Class I AQRV impact analyses required from this source. US Wind notes that other offshore wind Projects located within 30km of the Brigantine Class I area prepared AQRV analyses as part of the OCS air permit applications submitted to the New Jersey Department of Environmental Protection (NJDEP) and determined that there is no potential for a significant impact. These two Projects (i.e., Atlantic Shores and Ocean Wind I) have Q/D values that range from 50.6 to 117.3 for the construction and commissioning period. As such, US Wind's Q/D during the construction/commissioning and O&M periods is less than 10% and 0.4%, respectively, of the Q/Ds for similar Projects that have demonstrated acceptable AQRV impacts in the Class I area.

With this letter, US Wind is formally requesting a determination that there is no need to perform a Class I area AQRV analysis for the Brigantine Wilderness Area as part of the facility's PSD and OCS Air Permit application. If you should require additional information on the proposed Project or have any questions, please do not hesitate to contact me at (201) 508-6964 or dometz@trccompanies.com.

TRC

Sincerely,

TRC

Darin Ometz
Senior Air Quality Project Manager

cc:

Ms. Catherine Collins, Environmental Engineer
U.S. Fish and Wildlife Service
Branch of Air and Water Quality Resources
7333 W. Jefferson Ave., Suite 375
Lakewood, CO 80235-2034
Catherine_Collins@fws.gov

Ms. LiAn Zhuang
Air Quality Modeler, Modeling and Analysis Division
1800 Washington Blvd.
Baltimore, MD 21230
Email: lian.zhuang@maryland.gov

US Wind, Inc.
Laurie Jodziewicz
Senior Director of Environmental Affairs
Email: l.jodziewicz@uswindinc.com

Appendix C
MDE Forms

AIR QUALITY PERMIT TO CONSTRUCT
APPLICATION CHECKLIST

OWNER OF EQUIPMENT/PROCESS	
COMPANY NAME:	US Wind, Inc.
COMPANY ADDRESS:	401 East Pratt Street, Baltimore, MD 21202
LOCATION OF EQUIPMENT/PROCESS	
PREMISES NAME:	Outer Continental Shelf (Lease Area OCS-A 0490)
PREMISES ADDRESS:	Outer Continental Shelf (Lease Area OCS-A 0490)
CONTACT INFORMATION FOR THIS PERMIT APPLICATION	
CONTACT NAME:	Laurie Jodziewicz
JOB TITLE:	Sr. Director of Environmental Affairs
PHONE NUMBER:	410-340-9428
EMAIL ADDRESS:	l.jodziewicz@uswindinc.com
DESCRIPTION OF EQUIPMENT OR PROCESS	
Outer Continental Shelf Wind Facility - See attached OCS air permit application.	

Application is hereby made to the Department of the Environment for a Permit to Construct for the following equipment or process as required by the State of Maryland Air Quality Regulation, COMAR 26.11.02.09.

Check each item that you have submitted as part of your application package.

- ☒ Application package cover letter describing the proposed project
- ☒ Complete application forms (Note the number of forms included or NA if not applicable.)

No. NA Form 5
No. NA Form 5T
No. NA Form 5EP
No. NA Form 6
No. NA Form 10
No. NA Form 11
No. NA Form 41
No. NA Form 42
No. 1 Form 44

- ☐ Vendor/manufacturer specifications/guarantees
- ☐ Evidence of Workman's Compensation Insurance
- ☐ Process flow diagrams with emission points
- ☐ Site plan including the location of the proposed source and property boundary
- ☐ Material balance data and all emissions calculations
- ☐ Material Safety Data Sheets (MSDS) or equivalent information for materials processed and manufactured.
- ☐ Certificate of Public Convenience and Necessity (CPCN) waiver documentation from the Public Service Commission (1)
- ☐ Documentation that the proposed installation complies with local zoning and land use requirements (2)

(1) Required for emergency and non-emergency generators installed on or after October 1, 2001 and rated at 2001 kW or more.

(2) Required for applications subject to Expanded Public Participation Requirements.

MARYLAND DEPARTMENT OF THE ENVIRONMENT

Air and Radiation Management Administration / Air Quality Permits Program
1800 Washington Boulevard, STE 720 Baltimore, MD 21230-1720
(410) 537-3230 ●1-800-633-6101 ● www.mde.state.md.us

Mail application to
MDE/ARMA
1800 Washington Blvd, Suite 720
Baltimore, MD 21230-1720

Don't forget to:
✓Sign the application
✓Include vendor literature

Air Quality Permit to Construct & Registration Application for

INTERNAL COMBUSTION ENGINES

(Electrical Power Generators, Power Equipment, Fire Protection Pumps)

1) Applicability

You must check off one the following items to use this application form

☑ Electrical power generation (off grid, base load, peak, load shaving,, etc)
- Use MDE Form 42 for emergency use only generators

☐ Power equipment (hydraulic, mechanical, etc)
☐ Fire protection pump

***For electrical power generators only**, you must check off one the following items to use this application form*

☑ I have a CPCN Exemption from the Public Service Commission for this generator
(contact the Public Service Commision at 410.767.8131)
☐ This generator was installed before October 1, 2001 and I do not need a CPCN Exemption

2) Business/Institution/Facility where the engine will be located ☐ Check if this is a federal facility

Name: Maryland Offshore Wind Project Phone: N/A

Street Address: N/A

City: N/A State: 410-340-9428 Zip Code: N/A County: N/A

3) Owner/Operator of the engine (if different than above)

Name: US Wind, Inc. Phone: ______

Mailing Address: 401 East Pratt Street

City: Baltimore State: MD Zip Code: 21202

4) Installer ☐ Check if installer is applying for permit. If checked, complete the following:

Name: ______ Phone: ______

Mailing Address: ______

City: ______ State: ______ Zip Code: ______

5) Engine Information

Installation Date	Engine Manufacturer & Model	Horsepower	Manufacture Date	Fuel Type
TBD	TBD	150 kW	TBD	Diesel

6) Operating Information

Intended use description: (Examples, "a portable generator at a construction site" or "peak shaving with the emergency generator", etc)

A 150 kW emergency generator locoated on each of the four (4) offshore substations.

Generators would complete weekly and annual testing during the Project's O&M phase.

24
Hours per day

1,000
Hours per year

7) Required Attachments

(Check that they are attached)

☐ Vendor literature **(TBD)**

☐ CPCN Exemption from the Public Service Commission **(Not required)**

- Electrical generators only
- Not needed for generators installed before October 1, 2001

8) Workers Compensation (Environmental article §1-202)

Workers insurance policy or binder number: TBD

☐ Check if self employed or otherwise exempt from this requirement

"I CERTIFY UNDER PENALTY OF LAW THAT THE INFORMATION SUBMITTED IN THIS REQUEST FOR COVERAGE IS, TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS."

Jeffrey Grybowski

Owners Signature	Printed Name & Title	Date
Jeffrey Grybowski	Jeffrey Grybowski, CEO	11/29/23

LEAVE BLANK, MDE use only

☐ Permit

☐ Registration (Less than 1,000 brake horsepower & installed prior to 11/24/03)

Permit/Registration Number: ________ - ____ - ________ - ________

AI: ________

	SOx	Nox	CO	VOC	PM	PM-10
Emissions Stack						
Fugitive						

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Foundation Installation Fallpipe vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________

Company Name: ____________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:

Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ 24-0
- Simple/Multiple Cyclones ☐ 24-1
- Spray/Adsorb Tower ☐ 24-2
- Venturi Scrubber ☐ 24-3
- Carbon Adsorber ☐ 24-4
- Electrostatic Precipitator ☐ 24-5
- Bag-house ☐ 24-6
- Thermal/Catalytic Afterburner ☐ 24-7
- Dry Scrubber ☐ 24-8
- Other ☐ 24-9

Describe ____________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____________ (Specify Type) 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only ☐ 67-1

Process Heat Only ☐ 67-2

Percent Process Heat ☐☐ 68-69

Oil Burner Type ☐ 70 — 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup

Coal Burner Type ☐ 71 — 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76) Winter ☐ (77-78) Spring ☐ (79-80) Summer ☐ (81-82) Fall ☐ (83-84)

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State______________________

Return to Local Jurisdiction Date ____________________ By ______________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ______________________________

17. Inventory Date (MM/YY) ☐ 171-174 SCC Code ☐ 178-185

18. Annual Operating Rate ☐ 186-192 Maximum Design Hourly Rate ☐ 193-199

Permit to Operate Month ☐ 200-201 Transaction Date ☐ 202-207 Staff Code ☐ 208-210 VOC ☐ 211 212 SIP Code ☐ 213 214

Regulation Code ☐ 215-218 Confidentiality ☐ 219

Point Description ☐ 220-238 Action ☐ 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Foundation Installtion Heavy Lift Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ 24-0
- Simple/Multiple Cyclones ☐ 24-1
- Spray/Adsorb Tower ☐ 24-2
- Venturi Scrubber ☐ 24-3
- Carbon Adsorber ☐ 24-4
- Electrostatic Precipitator ☐ 24-5
- Bag-house ☐ 24-6
- Thermal/Catalytic Afterburner ☐ 24-7
- Dry Scrubber ☐ 24-8
- Other ☐ 24-9

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) ☐ 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) ☐ 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only ☐ 67-1

Process Heat Only ☐ 67-2

Percent Process Heat ☐☐ 68-69

Oil Burner Type ☐ 70 — 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup

Coal Burner Type ☐ 71 — 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 3 6 5 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76) Winter ☐☐ 77-78 Spring ☐☐ 79-80 Summer ☐☐ 81-82 Fall ☐☐ 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day

Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_____________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ______________________ Rev'd by State: Date__________ By ______________________

Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY) ☐☐☐☐ 171-174

SCC Code ☐☐☐☐☐☐☐☐ 178-185

18. Annual Operating Rate ☐☐☐☐☐☐☐ 186-192

Maximum Design Hourly Rate ☐☐☐☐☐☐☐ 193-199

Permit to Operate Month ☐☐ 200-201

Transaction Date ☐☐☐☐☐☐ 202-207

Staff Code ☐☐☐ 208-210

VOC ☐☐ 211 212

SIP Code ☐☐ 213 214

Regulation Code ☐☐☐☐ 215-218

Confidentiality ☐ 219

Point Description ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ 220-238

Action ☐ 239 — A: Add, C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

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Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Foundation Instalation Tugs

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________

Company Name: ____________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 4

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:

Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None	Simple/Multiple Cyclones	Spray/Adsorb Tower	Venturi Scrubber	Carbon Adsorber	Electrostatic Precipitator	Bag-house
X	☐	☐	☐	☐	☐	☐
24-0	24-1	24-2	24-3	24-4	24-5	24-6

Thermal/Catalytic Afterburner	Dry Scrubber	Other	Describe
☐	☐	☐	____________
24-7	24-8	24-9	

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ______________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ______________________________

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
☐☐ **1-2**	☐☐☐☐ **3-6**
Registration Class ☐ 7	**Equipment No.** ☐☐☐☐ 6-11
Data Year ☐☐ **12-13**	______ **Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Foundation Installation CTV

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:

Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None ☒ 24-0	Simple/Multiple Cyclones ☐ 24-1	Spray/Adsorb Tower ☐ 24-2	Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4	Electrostatic Precipitator ☐ 24-5	Bag-house ☐ 24-6	Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8	Other ☐ 24-9	Describe ______	

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ______________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________ Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ______________________________

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

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APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6

Registration Class	Equipment No.
7	6-11

Data Year
12-13

Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Foundation Installation OSV Noise Vessels

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 2

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:

Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None ☒ 24-0
Simple/Multiple Cyclones ☐ 24-1
Spray/Adsorb Tower ☐ 24-2
Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4
Electrostatic Precipitator ☐ 24-5
Bag-house ☐ 24-6
Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8
Other ☐ 24-9
Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week [7] 72

Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP [4] 165 SOx [4] 166 NOx [4] 167 CO [4] 168 VOC [4] 169 PM10 [4] 170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ____________________

Rev'd by Local Jurisdiction: Date __________ By ____________________ Rev'd by State: Date__________ By ____________________

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18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

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Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

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Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

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A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Foundation Installation Environmental CTVs

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________________

Company Name: ____________________ Expiration Date ____________

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6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 2

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	Checked
None	24-0	X
Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ____________________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____________ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

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Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

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Days Per Week [7] 72

Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
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13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State______________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ____________________Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ❑ Initial Registration ❑

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. ☐☐ **1-2** **Premises No.** ☐☐☐☐ **3-6**

Registration Class ☐ 7 **Equipment No.** ☐☐☐☐ 6-11

Data Year ☐☐ **12-13** **Application Date** ______

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
WTG Installation Jack-up vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Checked	Code
None	X	24-0
Simple/Multiple Cyclones		24-1
Spray/Adsorb Tower		24-2
Venturi Scrubber		24-3
Carbon Adsorber		24-4
Electrostatic Precipitator		24-5
Bag-house		24-6
Thermal/Catalytic Afterburner		24-7
Dry Scrubber		24-8
Other		24-9

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____________ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1 Process Heat Only [ ] 67-2 Percent Process Heat [ ] 68-69 Oil Burner Type [ ] 70 (1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup) Coal Burner Type [ ] 71 (1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired)

Days Per Week [7] 72 Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP [4] 165 SOx [4] 166 NOx [4] 167 CO [4] 168 VOC [4] 169 PM10 [4] 170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local________________ Date Rec'd State________________

Return to Local Jurisdiction Date ________________ By ________________

Rev'd by Local Jurisdiction: Date ________ By ________________ Rev'd by State: Date________ By ________________

Acknowledgement Sent by State: Date ____________ By ________________

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ❑ Initial Registration ❑

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.	Registration Class	Equipment No.	Data Year	Application Date
1-2	3-6	7	6-11	12-13	

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
WTG Installation Tugs

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 3

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None ☒ 24-0
Simple/Multiple Cyclones ☐ 24-1
Spray/Adsorb Tower ☐ 24-2
Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4
Electrostatic Precipitator ☐ 24-5
Bag-house ☐ 24-6
Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8
Other ☐ 24-9
Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None	Winter	Spring	Summer	Fall
X				
76	77-78	79-80	81-82	83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local ______ Date Rec'd State ______

Return to Local Jurisdiction Date ______ By ______

Rev'd by Local Jurisdiction: Date ______ By ______ Rev'd by State: Date ______ By ______

Acknowledgement Sent by State: Date ______ By ______

17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
WTG Commissioning CTVs

5. Workmen's Compensation Coverage: Binder/Policy Number: ____

Company Name: ____ Expiration Date ____

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 3

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Checked	Code
None	X	24-0
Simple/Multiple Cyclones		24-1
Spray/Adsorb Tower		24-2
Venturi Scrubber		24-3
Carbon Adsorber		24-4
Electrostatic Precipitator		24-5
Bag-house		24-6
Thermal/Catalytic Afterburner		24-7
Dry Scrubber		24-8
Other		24-9

Describe ____

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS: T B D (26-31)
SULFUR % (32-33)
GRADE (34)
NATURAL GAS-1000 FT^3 (35-41)
LP GAS-100 GALLONS (42-45)
GRADE

COAL- TONS (46-52)
SULFUR % (53-55)
ASH% (56-58)
WOOD-TONS (59-63)
MOISTURE % (64-65)

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only (67-1)
Process Heat Only (67-2)
Percent Process Heat (68-69)
Oil Burner Type (70): 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup
Coal Burner Type (71): 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week: 7 (72)
Days Per Year: 3 6 5 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76)
Winter (77-78)
Spring (79-80)
Summer (81-82)
Fall (83-84)

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter (99-104)
Oxides of Sulfur (105-110)
Oxides of Nitrogen (111-116)
Carbon Monoxide (117-122)
Volatile Organic Compounds (123-128)
PM-10 (129-134)

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State________________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ____________________Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY) (171-174)
SCC Code (178-185)
18. Annual Operating Rate (186-192)
Maximum Design Hourly Rate (193-199)

Permit to Operate Month (200-201)
Transaction Date (202-207)
Staff Code (208-210)
VOC (211 212)
SIP Code (213 214)

Regulation Code (215-218)
Confidentiality (219)

Point Description (220-238)
Action (239): A: Add, C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

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APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
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City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
OSS Installation Heavy lift vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________

Company Name: ____________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None	Simple/Multiple Cyclones	Spray/Adsorb Tower	Venturi Scrubber	Carbon Adsorber	Electrostatic Precipitator	Bag-house
X	☐	☐	☐	☐	☐	☐
24-0	24-1	24-2	24-3	24-4	24-5	24-6

Thermal/Catalytic Afterburner	Dry Scrubber	Other	Describe
☐	☐	☐	____________
24-7	24-8	24-9	

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) ☐ 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) ☐ 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only ☐ 67-1

Process Heat Only ☐ 67-2

Percent Process Heat ☐☐ 68-69

Oil Burner Type ☐ 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type ☐ 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76) Winter ☐ 77-78 Spring ☐ 79-80 Summer ☐ 81-82 Fall ☐ 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_____________________

Return to Local Jurisdiction Date ____________________ By ________________________

Rev'd by Local Jurisdiction: Date _________ By ____________________ Rev'd by State: Date_________ By ____________________

Acknowledgement Sent by State: Date _____________ By ____________________________

17. Inventory Date (MM/YY) ☐ 171-174

SCC Code ☐ 178-185

18. Annual Operating Rate ☐ 186-192

Maximum Design Hourly Rate ☐ 193-199

Permit to Operate Month ☐ 200-201

Transaction Date ☐ 202-207

Staff Code ☐ 208-210

VOC ☐ 211 212

SIP Code ☐ 213 214

Regulation Code ☐ 215-218

Confidentiality ☐ 219

Point Description ☐ 220-238

Action ☐ 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

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Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

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2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
OSS Installation Tug

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________________

Company Name: ____________________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 2

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None ☒ 24-0
Simple/Multiple Cyclones ☐ 24-1
Spray/Adsorb Tower ☐ 24-2
Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4
Electrostatic Precipitator ☐ 24-5
Bag-house ☐ 24-6
Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8
Other ☐ 24-9
Describe ____________________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week [7] 72

Days Per Year [365] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None	Winter	Spring	Summer	Fall
X				
76	77-78	79-80	81-82	83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
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14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State______________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ______________________Rev'd by State: Date__________ By ______________________

Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY) 171-174

SCC Code 178-185

18. Annual Operating Rate 186-192

Maximum Design Hourly Rate 193-199

Permit to Operate Month 200-201

Transaction Date 202-207

Staff Code 208-210

VOC 211 212

SIP Code 213 214

Regulation Code 215-218

Confidentiality 219

Point Description 220-238

Action 239 — A: Add, C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. (1-2)	Premises No. (3-6)	Registration Class (7)	Equipment No. (6-11)	Data Year (12-13)	Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status (15)	New Construction Began (MM/YY) (16-19)	New Construction Completed (MM/YY) (20-23)	Existing Initial Operation (MM/YY) (20-23)
A			

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
OSS Installation OSV

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 2

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ (24-0)
- Simple/Multiple Cyclones ☐ (24-1)
- Spray/Adsorb Tower ☐ (24-2)
- Venturi Scrubber ☐ (24-3)
- Carbon Adsorber ☐ (24-4)
- Electrostatic Precipitator ☐ (24-5)
- Bag-house ☐ (24-6)
- Thermal/Catalytic Afterburner ☐ (24-7)
- Dry Scrubber ☐ (24-8)
- Other ☐ (24-9)

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ________ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ________ (Specify Units of Measure)

OTHER FUEL ________ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76) Winter: (77-78) Spring: (79-80) Summer: (81-82) Fall: (83-84)

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________ Date Rec'd State__________

Return to Local Jurisdiction Date __________ By __________

Rev'd by Local Jurisdiction: Date ______ By __________ Rev'd by State: Date______ By __________

Acknowledgement Sent by State: Date ______ By __________

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX
2. Registration Number
County No. 1-2 Premises No. 3-6
Registration Class 7 Equipment No. 6-11
Data Year 12-13 Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):
Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status
A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
OSS Installation Topside Tug

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________

Company Name: ____________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ 24-0
- Simple/Multiple Cyclones ☐ 24-1
- Spray/Adsorb Tower ☐ 24-2
- Venturi Scrubber ☐ 24-3
- Carbon Adsorber ☐ 24-4
- Electrostatic Precipitator ☐ 24-5
- Bag-house ☐ 24-6
- Thermal/Catalytic Afterburner ☐ 24-7
- Dry Scrubber ☐ 24-8
- Other ☐ 24-9

Describe ____________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____________ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local ____________ Date Rec'd State ____________

Return to Local Jurisdiction Date ____________ By ____________

Rev'd by Local Jurisdiction: Date ________ By ____________ Rev'd by State: Date ________ By ____________

Acknowledgement Sent by State: Date ____________ By ____________

17. Inventory Date (MM/YY) [ ] 171-174

SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192

Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201

Transaction Date [ ] 202-207

Staff Code [ ] 208-210

VOC [ ] 211 212

SIP Code [ ] 213 214

Regulation Code [ ] 215-218

Confidentiality [ ] 219

Point Description [ ] 220-238

Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX
2. Registration Number
County No. ☐☐ **1-2** **Premises No.** ☐☐☐☐ **3-6**
Registration Class ☐ 7 **Equipment No.** ☐☐☐☐ 6-11
Data Year ☐☐ **12-13**
Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):
Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status
A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
OSS Installation Refueling OSV

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	
None	24-0	X
Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1 Process Heat Only [ ] 67-2 Percent Process Heat [ ] 68-69 Oil Burner Type [ ] 70

1=Pressure Gun
2=Air Atomizer
3=Steam Atomizer
4=Rotary Cup

Coal Burner Type [ ] 71

1=Cyclone
2=Stoker
3=Pulverized
4=Hand Fired

Days Per Week [7] 72 Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date _________ By _____________________Rev'd by State: Date_________ By _____________________

Acknowledgement Sent by State: Date _____________ By ____

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
☐☐	☐☐☐☐
1-2	**3-6**
Registration Class	**Equipment No.**
☐	☐☐☐☐
7	6-11
Data Year ☐☐	______
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A	☐☐☐☐	☐☐☐☐	☐☐☐☐
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
OSS Installation Hotel Jack-up vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________________

Company Name: ____________________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None	Simple/Multiple Cyclones	Spray/Adsorb Tower	Venturi Scrubber	Carbon Adsorber	Electrostatic Precipitator	Bag-house
X	☐	☐	☐	☐	☐	☐
24-0	24-1	24-2	24-3	24-4	24-5	24-6

Thermal/Catalytic Afterburner	Dry Scrubber	Other	Describe
☐	☐	☐	______
24-7	24-8	24-9	______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [365] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ____

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Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

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Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. (1-2)	Premises No. (3-6)

Registration Class (7)	Equipment No. (6-11)

Data Year (12-13) ____ Application Date ____

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status (15)	New Construction Began (MM/YY) (16-19)	New Construction Completed (MM/YY) (20-23)	Existing Initial Operation (MM/YY) (20-23)
A			

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Array cable lay vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____

Company Name: ____ Expiration Date ____

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

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8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	Selected
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Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ____

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____________ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1 Process Heat Only [ ] 67-2 Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week [7] 72 Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_____________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ____________________ Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Array offshore support vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:

Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	Selected
None	24-0	X
Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS: [ ][ ][ ][T][B][D] 26-31
SULFUR %: [ ][ ] 32-33
GRADE: [ ] 34
NATURAL GAS-1000 FT^3: [ ][ ][ ][ ][ ][ ][ ] 35-41
LP GAS-100 GALLONS: [ ][ ][ ][ ] 42-45
GRADE: [ ]

COAL- TONS: 46-52
SULFUR %: 53-55
ASH%: 56-58
WOOD-TONS: 59-63
MOISTURE %: 64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1
Process Heat Only [ ] 67-2
Percent Process Heat [ ][ ] 68-69
Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup
Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72
Days Per Year [3][6][5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76
Winter [ ][ ] 77-78
Spring [ ][ ] 79-80
Summer [ ][ ] 81-82
Fall [ ][ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft): [T][B][D] 86-88
Inside Diameter at Top (inches): [T][B][D] 89-91
Exit Temperature (°F): [T][B][D][ ] 92-95
Exit Velocity (ft/sec): [T][B][D] 96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104
Oxides of Sulfur [ ] 105-110
Oxides of Nitrogen [ ] 111-116
Carbon Monoxide [ ] 117-122
Volatile Organic Compounds [ ] 123-128
PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP [4] 165
SOx [4] 166
NOx [4] 167
CO [4] 168
VOC [4] 169
PM10 [4] 170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ______________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________ Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ______________________________

17. Inventory Date (MM/YY) [ ] 171-174
SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192
Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201
Transaction Date [ ] 202-207
Staff Code [ ] 208-210
VOC [ ][ ] 211 212
SIP Code [ ][ ] 213 214

Regulation Code [ ] 215-218
Confidentiality [ ] 219

Point Description [ ] 220-238
Action [ ] 239 — A: Add C: Change

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Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

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2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status
A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Array CTV

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 2

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None ☒ 24-0
Simple/Multiple Cyclones ☐ 24-1
Spray/Adsorb Tower ☐ 24-2
Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4
Electrostatic Precipitator ☐ 24-5
Bag-house ☐ 24-6
Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8
Other ☐ 24-9
Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ____ (Specify Units of Measure)

OTHER FUEL ____ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ____ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1
Process Heat Only [ ] 67-2
Percent Process Heat [ ] 68-69
Oil Burner Type [ ] 70 — 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup
Coal Burner Type [ ] 71 — 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week [7] 72
Days Per Year [365] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104
Oxides of Sulfur [ ] 105-110
Oxides of Nitrogen [ ] 111-116
Carbon Monoxide [ ] 117-122
Volatile Organic Compounds [ ] 123-128
PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State______________________

Return to Local Jurisdiction Date ____________________ By ________________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ________________________________

17. Inventory Date (MM/YY) [ ] 171-174
SCC Code [ ] 178-185
18. Annual Operating Rate [ ] 186-192
Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201
Transaction Date [ ] 202-207
Staff Code [ ] 208-210
VOC [ ] 211 212
SIP Code [ ] 213 214

Regulation Code [ ] 215-218
Confidentiality [ ] 219

Point Description [ ] 220-238
Action [ ] 239 A: Add C: Change

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APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Laurie Jodziewicz Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Array trenching vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ 24-0
- Simple/Multiple Cyclones ☐ 24-1
- Spray/Adsorb Tower ☐ 24-2
- Venturi Scrubber ☐ 24-3
- Carbon Adsorber ☐ 24-4
- Electrostatic Precipitator ☐ 24-5
- Bag-house ☐ 24-6
- Thermal/Catalytic Afterburner ☐ 24-7
- Dry Scrubber ☐ 24-8
- Other ☐ 24-9

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____________ (Specify Type) 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only 67-1

Process Heat Only 67-2

Percent Process Heat 68-69

Oil Burner Type 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76) Winter (77-78) Spring (79-80) Summer (81-82) Fall (83-84)

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter 99-104

Oxides of Sulfur 105-110

Oxides of Nitrogen 111-116

Carbon Monoxide 117-122

Volatile Organic Compounds 123-128

PM-10 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State________________

Return to Local Jurisdiction Date __________________ By ______________________________

Rev'd by Local Jurisdiction: Date _________ By __________________ Rev'd by State: Date_________ By ________________

Acknowledgement Sent by State: Date _____________ By ______________________________

17. Inventory Date (MM/YY) 171-174

SCC Code 178-185

18. Annual Operating Rate 186-192

Maximum Design Hourly Rate 193-199

Permit to Operate Month 200-201

Transaction Date 202-207

Staff Code 208-210

VOC 211 212

SIP Code 213 214

Regulation Code 215-218

Confidentiality 219

Point Description 220-238

Action 239 — A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

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APPLICATION FOR FUEL BURNING EQUIPMENT

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Mailing Address/Street
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Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

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2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Array guard vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________

Company Name: ____________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	Checked
None	24-0	X
Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ____________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None	Winter	Spring	Summer	Fall
X				
76	77-78	79-80	81-82	83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

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17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Export Cable lay vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

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Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

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Days Per Week [7] 72

Days Per Year [365] 73-75

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None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

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Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
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Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

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Air and Radiation Management Administration Use Only

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Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ______________________Rev'd by State: Date__________ By ______________________

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17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6

Registration Class	Equipment No.
7	6-11

Data Year
12-13

Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Export Cable Multipurpose OSV

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ 24-0
- Simple/Multiple Cyclones ☐ 24-1
- Spray/Adsorb Tower ☐ 24-2
- Venturi Scrubber ☐ 24-3
- Carbon Adsorber ☐ 24-4
- Electrostatic Precipitator ☐ 24-5
- Bag-house ☐ 24-6
- Thermal/Catalytic Afterburner ☐ 24-7
- Dry Scrubber ☐ 24-8
- Other ☐ 24-9

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ____________ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None	Winter	Spring	Summer	Fall
X				
76	77-78	79-80	81-82	83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ___________________ By ______________________________________

Rev'd by Local Jurisdiction: Date _________ By ____________________Rev'd by State: Date_________ By ____________________

Acknowledgement Sent by State: Date _____________ By ____

17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code [ ] 215-218

Confidentiality [ ] 219

Point Description [ ] 220-238

Action [ ] 239 — A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

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APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ❑ Initial Registration ❑

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. **1-2** **Premises No.** **3-6**

Registration Class 7 **Equipment No.** 6-11

Data Year **12-13** **Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Export Cable Trenching Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	Checked
None	24-0	X
Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS: T B D (26-31) | SULFUR %: (32-33) | GRADE: (34) | NATURAL GAS-1000 FT^3: (35-41) | LP GAS-100 GALLONS: (42-45) | GRADE

COAL- TONS: (46-52) | SULFUR %: (53-55) | ASH%: (56-58) | WOOD-TONS: (59-63) | MOISTURE %: (64-65)

OTHER FUELS ______ (Specify Type) | 66-1 | ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure) | OTHER FUEL ______ (Specify Type) | 66-2 | ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only: (67-1) | Process Heat Only: (67-2) | Percent Process Heat: (68-69) | Oil Burner Type: (70) 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup | Coal Burner Type: (71) 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72) | Days Per Year: 3 6 5 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76) | Winter: (77-78) | Spring: (79-80) | Summer: (81-82) | Fall: (83-84)

12. Exhaust Stack Information

Height Above Ground (ft): T B D (86-88) | Inside Diameter at Top (inches): T B D (89-91) | Exit Temperature (°F): T B D (92-95) | Exit Velocity (ft/sec): T B D (96-98)

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter: (99-104) | Oxides of Sulfur: (105-110) | Oxides of Nitrogen: (111-116)

Carbon Monoxide: (117-122) | Volatile Organic Compounds: (123-128) | PM-10: (129-134)

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP: 4 (165) | SOx: 4 (166) | NOx: 4 (167) | CO: 4 (168) | VOC: 4 (169) | PM10: 4 (170)

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ______________________Rev'd by State: Date__________ By ______________________

Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY): (171-174) | SCC Code: (178-185)

18. Annual Operating Rate: (186-192) | Maximum Design Hourly Rate: (193-199)

Permit to Operate Month: (200-201) | Transaction Date: (202-207) | Staff Code: (208-210) | VOC: (211 212) | SIP Code: (213 214)

Regulation Code: (215-218) | Confidentiality: (219)

Point Description: (220-238) | Action: (239) A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. ☐☐ **1-2**

Premises No. ☐☐☐☐ **3-6**

Registration Class ☐ 7

Equipment No. ☐☐☐☐ 6-11

Data Year ☐☐ **12-13**

______ **Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status
A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Export Cable HDD Lift Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None ☒ 24-0
Simple/Multiple Cyclones ☐ 24-1
Spray/Adsorb Tower ☐ 24-2
Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4
Electrostatic Precipitator ☐ 24-5
Bag-house ☐ 24-6
Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8
Other ☐ 24-9
Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None	Winter	Spring	Summer	Fall
X				
76	77-78	79-80	81-82	83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State______________________

Return to Local Jurisdiction Date ____________________ By ____

Rev'd by Local Jurisdiction: Date __________ By ______________________Rev'd by State: Date__________ By ______________________

Acknowledgement Sent by State: Date ______________ By ____

17. Inventory Date (MM/YY) 171-174

SCC Code 178-185

18. Annual Operating Rate 186-192

Maximum Design Hourly Rate 193-199

Permit to Operate Month 200-201

Transaction Date 202-207

Staff Code 208-210

VOC 211 212

SIP Code 213 214

Regulation Code 215-218

Confidentiality 219

Point Description 220-238

Action 239 — A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX
2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	Application Date
12-13	

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status
A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Export Cable HDD pull in Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	Checked
None	24-0	X
Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired

Days Per Week [7] 72

Days Per Year [365] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP [4] 165 SOx [4] 166 NOx [4] 167 CO [4] 168 VOC [4] 169 PM10 [4] 170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local __________ Date Rec'd State __________

Return to Local Jurisdiction Date __________ By __________

Rev'd by Local Jurisdiction: Date ______ By __________ Rev'd by State: Date ______ By __________

Acknowledgement Sent by State: Date ______ By __________

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

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Registration Class	Equipment No.
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Data Year	Application Date
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1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):
Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status
A= New Equipment
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C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Export Cable pull in support vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________________

Company Name: ____________________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

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8. Major Activity, Product or Service of Company at this Location:
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9. Control Devices Associated with this Equipment

None ☒ 24-0
Simple/Multiple Cyclones ☐ 24-1
Spray/Adsorb Tower ☐ 24-2
Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4
Electrostatic Precipitator ☐ 24-5
Bag-house ☐ 24-6
Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8
Other ☐ 24-9
Describe____________________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS [| | | T | B | D] 26-31

SULFUR % [ ] 32-33

GRADE [ ] 34

NATURAL GAS-1000 FT^3 [ ] 35-41

LP GAS-100 GALLONS [ ] 42-45

GRADE [ ]

COAL- TONS [ ] 46-52

SULFUR % [ ] 53-55

ASH% [ ] 56-58

WOOD-TONS [ ] 59-63

MOISTURE % [ ] 64-65

OTHER FUELS ____________ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

OTHER FUEL ____________ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ____________ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [3 | 6 | 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104

Oxides of Sulfur [ ] 105-110

Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122

Volatile Organic Compounds [ ] 123-128

PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State______________________

Return to Local Jurisdiction Date ____________________ By ________________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________ Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ________________________________

17. Inventory Date (MM/YY) [ ] 171-174

SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192

Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201

Transaction Date [ ] 202-207

Staff Code [ ] 208-210

VOC [ ] 211 212

SIP Code [ ] 213 214

Regulation Code [ ] 215-218

Confidentiality [ ] 219

Point Description [ ] 220-238

Action [ ] 239 A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪ 1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Operation Scour Protection Repair Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________

Company Name: ____________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ 24-0
- Simple/Multiple Cyclones ☐ 24-1
- Spray/Adsorb Tower ☐ 24-2
- Venturi Scrubber ☐ 24-3
- Carbon Adsorber ☐ 24-4
- Electrostatic Precipitator ☐ 24-5
- Bag-house ☐ 24-6
- Thermal/Catalytic Afterburner ☐ 24-7
- Dry Scrubber ☐ 24-8
- Other ☐ 24-9

Describe ____________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only 67-1 | Process Heat Only 67-2 | Percent Process Heat 68-69 | Oil Burner Type 70 (1=Pressure Gun, 2=Air Atomizer, 3=Steam Atomizer, 4=Rotary Cup) | Coal Burner Type 71 (1=Cyclone, 2=Stoker, 3=Pulverized, 4=Hand Fired)

SEASONAL VARIATION IN OPERATION (PERCENT):

Days Per Week	Days Per Year	None	Winter	Spring	Summer	Fall
7	365	X				
72	73-75	76	77-78	79-80	81-82	83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________ Date Rec'd State__________

Return to Local Jurisdiction Date __________ By __________

Rev'd by Local Jurisdiction: Date ______ By __________ Rev'd by State: Date______ By __________

Acknowledgement Sent by State: Date ______ By __________

17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code 215-218 Confidentiality 219

Point Description 220-238 Action 239 A: Add C: Change

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City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

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2. Registration Number

County No.	Premises No.
☐☐	☐☐☐☐
1-2	**3-6**
Registration Class	**Equipment No.**
☐	☐☐☐☐
7	6-11
Data Year	
☐☐	______
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

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A= New Equipment
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C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Operation Refueling Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______________________

Company Name: ______________________ Expiration Date ______________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Mark	Code
None	X	24-0
Simple/Multiple Cyclones	☐	24-1
Spray/Adsorb Tower	☐	24-2
Venturi Scrubber	☐	24-3
Carbon Adsorber	☐	24-4
Electrostatic Precipitator	☐	24-5
Bag-house	☐	24-6
Thermal/Catalytic Afterburner	☐	24-7
Dry Scrubber	☐	24-8
Other	☐	24-9

Describe______________________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT³	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week: 7 (72)

Days Per Year: 365 (73-75)

SEASONAL VARIATION IN OPERATION (PERCENT):

None: X (76) Winter: ___ (77-78) Spring: ___ (79-80) Summer: ___ (81-82) Fall: ___ (83-84)

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ______________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ______________________________

17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

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2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Operation Main Repair Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

Device	Code	Checked
None	24-0	X
Simple/Multiple Cyclones	24-1	
Spray/Adsorb Tower	24-2	
Venturi Scrubber	24-3	
Carbon Adsorber	24-4	
Electrostatic Precipitator	24-5	
Bag-house	24-6	
Thermal/Catalytic Afterburner	24-7	
Dry Scrubber	24-8	
Other	24-9	

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [365] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP [4] 165 SOx [4] 166 NOx [4] 167 CO [4] 168 VOC [4] 169 PM10 [4] 170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State_______________________

Return to Local Jurisdiction Date ____________________ By ______________________________

Rev'd by Local Jurisdiction: Date __________ By ____________________Rev'd by State: Date__________ By ____________________

Acknowledgement Sent by State: Date ______________ By ______________________________

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: [signature] Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No.	Premises No.
1-2	3-6
Registration Class	**Equipment No.**
7	6-11
Data Year	
12-13	**Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

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B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Operation survey vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 2

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

- None ☒ 24-0
- Simple/Multiple Cyclones ☐ 24-1
- Spray/Adsorb Tower ☐ 24-2
- Venturi Scrubber ☐ 24-3
- Carbon Adsorber ☐ 24-4
- Electrostatic Precipitator ☐ 24-5
- Bag-house ☐ 24-6
- Thermal/Catalytic Afterburner ☐ 24-7
- Dry Scrubber ☐ 24-8
- Other ☐ 24-9

Describe ______

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
TBD					
26-31	32-33	34	35-41	42-45	

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Days Per Week [7] 72

Days Per Year [365] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None	Winter	Spring	Summer	Fall
X				
76	77-78	79-80	81-82	83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
TBD	TBD	TBD	TBD
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13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
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Carbon Monoxide	Volatile Organic Compounds	PM-10
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State________________________

Return to Local Jurisdiction Date ____________________ By ______________________________

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Registration Class (7)	Equipment No. (6-11)
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15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
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5. Workmen's Compensation Coverage: Binder/Policy Number: ______

Company Name: ______ Expiration Date ______

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9. Control Devices Associated with this Equipment

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Days Per Week [7] 72
Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

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Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

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4	4	4	4	4	4
165	166	167	168	169	170

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18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

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Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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1A. Owner of Equipment/Company Name
US Wind, Inc.

Mailing Address/Street
401 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number N/A

Print Name/Title
Laurie Jodziewicz -Sr. Director of Environmental Affairs

Signature: Date: November 22, 2023

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. ☐☐ **1-2** **Premises No.** ☐☐☐☐ **3-6**

Registration Class ☐ 7 **Equipment No.** ☐☐☐☐ 6-11

Data Year ☐☐ **12-13**

____________ **Application Date**

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):

Outer Continental Shelf Wind Facility - See attached OCS air permit application.

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A			
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Operation Environmental Monitoring Vessel

5. Workmen's Compensation Coverage: Binder/Policy Number: ____________

Company Name: ____________ Expiration Date ____________

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 1

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number):
Offshore Wind Construction Contractor - TBD

8. Major Activity, Product or Service of Company at this Location:
Outer Continental Shelf Wind Facility

9. Control Devices Associated with this Equipment

None ☒ 24-0
Simple/Multiple Cyclones ☐ 24-1
Spray/Adsorb Tower ☐ 24-2
Venturi Scrubber ☐ 24-3
Carbon Adsorber ☐ 24-4
Electrostatic Precipitator ☐ 24-5
Bag-house ☐ 24-6
Thermal/Catalytic Afterburner ☐ 24-7
Dry Scrubber ☐ 24-8
Other ☐ 24-9
Describe ____________

10. Annual Fuel Consumption for this Equipment Only

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
T B D					
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS ______ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

OTHER FUEL ______ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED ______ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1

Process Heat Only [ ] 67-2

Percent Process Heat [ ] 68-69

Oil Burner Type [ ] 70 — 1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup

Coal Burner Type [ ] 71 — 1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired

Days Per Week [7] 72

Days Per Year [3 6 5] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
T B D	T B D	T B D	T B D
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day Refer to Table C-1

Particulate Matter [ ] 99-104 Oxides of Sulfur [ ] 105-110 Oxides of Nitrogen [ ] 111-116

Carbon Monoxide [ ] 117-122 Volatile Organic Compounds [ ] 123-128 PM-10 [ ] 129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? TBD

Air and Radiation Management Administration Use Only

16. Date Rec'd Local__________________ Date Rec'd State________________

Return to Local Jurisdiction Date ____________ By ____________

Rev'd by Local Jurisdiction: Date ________ By ____________ Rev'd by State: Date________ By ____________

Acknowledgement Sent by State: Date ____________ By ____________

17. Inventory Date (MM/YY) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

Permit to Operate Month [ ] 200-201 Transaction Date [ ] 202-207 Staff Code [ ] 208-210 VOC [ ] 211 212 SIP Code [ ] 213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

Table C-1
US Wind
Maryland Offshore Wind Project
Daily Air Emissions - Construction and Operation

Activity	Representative Vessel Type	MDE Form 11 Vessel ID	AERMOD ID	Engine Operation	Daily Operation Hours	Annual Operating Hours - Construction Period	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	VOC (lb/hr)	NOx (lb/day)	CO (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)	SO2 (lb/day)	VOC (lb/day)
Foundation Installation																		
Scour protection installation vessel	Fallpipe vessel	Foundation Installation Fallpipe vessel	FV1T1	Main Engine - In Transit	2	16	2.34E+02	5.43E+01	8.40E+00	8.15E+00	2.10E+00	6.18E+00	1.71E+03	3.97E+02	6.13E+01	5.95E+01	1.53E+01	4.51E+01
			FV1M1	Main Engine - Maneuvering	24	1015	5.65E+01	1.31E+01	2.02E+00	1.96E+00	5.06E-01	1.49E+00						
			FV1AT1	Auxiliary Engines - Transit	2	16	2.90E+00	7.26E-01	9.37E-02	9.08E-02	1.76E-03	4.10E-02	2.83E+02	7.09E+01	9.14E+00	8.86E+00	1.71E-01	4.00E+00
			FV1AM1	Auxiliary Engines - Maneuvering	24	1015	1.18E+01	2.95E+00	3.81E-01	3.69E-01	7.14E-03	1.67E-01						
Foundation installation vessel	Heavy lift vessel	Foundation Installtion Heavy Lift Vessel	FV2T1	Main Engine - In Transit	2	6	4.13E+02	9.47E+01	1.28E+01	1.24E+01	5.35E-01	5.76E+00	1.92E+03	4.40E+02	5.94E+01	5.74E+01	2.49E+00	2.68E+01
			FV2M1	Main Engine - Maneuvering	24	1865	4.98E+01	1.14E+01	1.54E+00	1.49E+00	6.45E-02	6.94E-01						
			FV2AT1	Auxiliary Engines - Transit	2	6	3.09E+01	6.64E+00	8.57E-01	8.30E-01	1.61E-02	3.75E-01	1.24E+03	2.66E+02	3.43E+01	3.32E+01	6.43E-01	1.50E+01
			FV2AM1	Auxiliary Engines - Maneuvering	24	1865	5.16E+01	1.11E+01	1.43E+00	1.38E+00	2.68E-02	6.25E-01						
Tug for assisting foundation installation 1 -- Offshore	Tug	Foundation Instalation Tugs	FV3T1	Main Engine - In Transit	2	15	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	4.33E+02	1.04E+02	1.50E+01	1.46E+01	1.50E+00	8.18E+00
			FV3M1	Main Engine - Maneuvering	12	933	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			FV3AT1	Auxiliary Engines - Transit	2	15	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	2.67E+01	6.55E+00	8.45E-01	8.19E-01	1.58E-02	3.70E-01
			FV3AM1	Auxiliary Engines - Maneuvering	12	933	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
Foundation transport tug 1	Tug		FV4T1	Main Engine - In Transit	2	34	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	5.61E+02	1.35E+02	1.94E+01	1.89E+01	1.94E+00	1.06E+01
			FV4M1	Main Engine - Maneuvering	18	258	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			FV4AT1	Auxiliary Engines - Transit	2	34	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	3.81E+01	9.36E+00	1.21E+00	1.17E+00	2.26E-02	5.28E-01
			FV4AM1	Auxiliary Engines - Maneuvering	18	258	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
Foundation transport tug 2	Tug		FV5T1	Main Engine - In Transit	2	33	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	5.61E+02	1.35E+02	1.94E+01	1.89E+01	1.94E+00	1.06E+01
			FV5M1	Main Engine - Maneuvering	18	245	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			FV5AT1	Auxiliary Engines - Transit	2	33	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	3.81E+01	9.36E+00	1.21E+00	1.17E+00	2.26E-02	5.28E-01
			FV5AM1	Auxiliary Engines - Maneuvering	18	245	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
Foundation transport tug 3	Tug		FV6T1	Main Engine - In Transit	2	28	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	5.61E+02	1.35E+02	1.94E+01	1.89E+01	1.94E+00	1.06E+01
			FV6M1	Main Engine - Maneuvering	18	209	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			FV6AT1	Auxiliary Engines - Transit	2	28	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	3.81E+01	9.36E+00	1.21E+00	1.17E+00	2.26E-02	5.28E-01
			FV6AM1	Auxiliary Engines - Maneuvering	18	209	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
Crew transfer vessel 1	Crew transfer vessel	Foundation Installation CTV	FV7T1	Main Engine - In Transit	2	34	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.11E+02	2.78E+01	3.75E+00	3.63E+00	7.25E-02	1.69E+00
			FV7M1	Main Engine - Maneuvering	10	259	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			FV7AT1	Auxiliary Engines - Transit	2	34	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	4.73E+00	1.13E+00	1.46E-01	1.41E-01	2.73E-03	6.37E-02
			FV7AM1	Auxiliary Engines - Maneuvering	10	259	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Noise mitigation vessel	OSV	Foundation Installation OSV Noise Vessels	FV8T1	Main Engine - In Transit	2	20	1.11E+02	2.79E+01	3.76E+00	3.63E+00	7.27E-02	1.70E+00	3.82E+02	9.60E+01	1.29E+01	1.25E+01	2.50E-01	5.84E+00
			FV8M1	Main Engine - Maneuvering	6	466	2.67E+01	6.71E+00	9.05E-01	8.76E-01	1.75E-02	4.09E-01						
			FV8AT1	Auxiliary Engines - Transit	2	20	9.26E+00	2.21E+00	2.85E-01	2.76E-01	5.35E-03	1.25E-01	1.11E+02	2.65E+01	3.42E+00	3.31E+00	6.42E-02	1.50E+00
			FV8AM1	Auxiliary Engines - Maneuvering	6	466	1.54E+01	3.68E+00	4.75E-01	4.60E-01	8.91E-03	2.08E-01						
Acoustic monitoring - buoy support vessel	OSV		FV9T1	Main Engine - In Transit	2	13	8.51E+01	2.14E+01	2.88E+00	2.79E+00	5.58E-02	1.30E+00	2.93E+02	7.37E+01	9.93E+00	9.61E+00	1.92E-01	4.48E+00
			FV9M1	Main Engine - Maneuvering	6	466	2.05E+01	5.15E+00	6.94E-01	6.72E-01	1.34E-02	3.14E-01						
			FV9AT1	Auxiliary Engines - Transit	2	13	2.55E+00	6.09E-01	7.86E-02	7.62E-02	1.47E-03	3.44E-02	2.04E+01	4.87E+00	6.29E-01	6.09E-01	1.18E-02	2.75E-01
			FV9AM1	Auxiliary Engines - Maneuvering	6	466	2.55E+00	6.09E-01	7.86E-02	7.62E-02	1.47E-03	3.44E-02						
Marine mammal observation 1	Crew transfer vessel	Foundation Installation Environmental CTVs	FV10T1	Main Engine - In Transit	2	169	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	8.64E+01	2.17E+01	2.93E+00	2.83E+00	5.67E-02	1.32E+00
			FV10M1	Main Engine - Maneuvering	6	311	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			FV10AT1	Auxiliary Engines - Transit	2	169	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	3.15E+00	7.52E-01	9.71E-02	9.40E-02	1.82E-03	4.25E-02
			FV10AM1	Auxiliary Engines - Maneuvering	6	311	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Environmental monitoring	Crew transfer vessel		FV11T1	Main Engine - In Transit	2	169	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	8.64E+01	2.17E+01	2.93E+00	2.83E+00	5.67E-02	1.32E+00
			FV11M1	Main Engine - Maneuvering	6	311	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			FV11AT1	Auxiliary Engines - Transit	2	169	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	3.15E+00	7.52E-01	9.71E-02	9.40E-02	1.82E-03	4.25E-02
			FV11AM1	Auxiliary Engines - Maneuvering	6	311	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
WTG Installation																		
WTG installation jack-up vessel	Jack-up installation vessel	WTG Installation Jack-up vessel	WV1T1	Main Engine - In Transit	2	9	2.09E+02	4.80E+01	6.47E+00	6.26E+00	2.71E-01	2.92E+00	4.18E+02	9.60E+01	1.29E+01	1.25E+01	5.42E-01	5.84E+00
			WV1M1	Main Engine - Maneuvering	24	4364	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
			WV1AT1	Auxiliary Engines - Transit	2	9	1.98E+01	4.25E+00	5.49E-01	5.31E-01	1.03E-02	2.40E-01	7.92E+02	1.70E+02	2.19E+01	2.13E+01	4.11E-01	9.60E+00
			WV1AM1	Auxiliary Engines - Maneuvering	24	4364	3.30E+01	7.09E+00	9.14E-01	8.86E-01	1.71E-02	4.00E-01						
Tug to transport WTG 1	Tug	WTG Installation Tugs	WV2T1	Main Engine - In Transit	2	95	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	6.46E+02	1.55E+02	2.24E+01	2.17E+01	2.24E+00	1.22E+01
			WV2M1	Main Engine - Maneuvering	24	949	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			WV2AT1	Auxiliary Engines - Transit	2	95	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	4.57E+01	1.12E+01	1.45E+00	1.40E+00	2.72E-02	6.34E-01
			WV2AM1	Auxiliary Engines - Maneuvering	24	949	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
Tug to transport WTG 2	Tug		WV3T1	Main Engine - In Transit	2	92	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	6.46E+02	1.55E+02	2.24E+01	2.17E+01	2.24E+00	1.22E+01
			WV3M1	Main Engine - Maneuvering	24	916	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			WV3AT1	Auxiliary Engines - Transit	2	92	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	4.57E+01	1.12E+01	1.45E+00	1.40E+00	2.72E-02	6.34E-01
			WV3AM1	Auxiliary Engines - Maneuvering	24	916	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
Tug to support WTG Installation / maneuvering offshore	Tug		WV4T1	Main Engine - In Transit	2	26	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	6.46E+02	1.55E+02	2.24E+01	2.17E+01	2.24E+00	1.22E+01
			WV4M1	Main Engine - Maneuvering	24	4364	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						

Activity	Representative Vessel Type	MDE Form 11 Vessel ID	AERMOD ID	Engine Operation	Daily Operation Hours	Annual Operating Hours - Construction Period	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	VOC (lb/hr)	NOx (lb/day)	CO (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)	SO2 (lb/day)	VOC (lb/day)
			WV4AT1	Auxiliary Engines - Transit	2	26	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	4.57E+01	1.12E+01	1.45E+00	1.40E+00	2.72E-02	6.34E-01
			WV4AM1	Auxiliary Engines - Maneuvering	24	4364	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
WTG Commissioning																		
Crew transfer vessel 1	Crew transfer vessel	WTG Commissioning CTVs	CV1T1	Main Engine - In Transit	2	215	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.23E+02	3.08E+01	4.16E+00	4.02E+00	8.04E-02	1.88E+00
			CV1M1	Main Engine - Maneuvering	12	2035	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			CV1AT1	Auxiliary Engines - Transit	2	215	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	5.52E+00	1.32E+00	1.70E-01	1.65E-01	3.19E-03	7.43E-02
			CV1AM1	Auxiliary Engines - Maneuvering	12	2035	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Crew transfer vessel 2	Crew transfer vessel		CV2T1	Main Engine - In Transit	2	212	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.23E+02	3.08E+01	4.16E+00	4.02E+00	8.04E-02	1.88E+00
			CV2M1	Main Engine - Maneuvering	12	2013	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			CV2AT1	Auxiliary Engines - Transit	2	212	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	5.52E+00	1.32E+00	1.70E-01	1.65E-01	3.19E-03	7.43E-02
			CV2AM1	Auxiliary Engines - Maneuvering	12	2013	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Crew transfer vessel 3	Crew transfer vessel		CV3T1	Main Engine - In Transit	2	124	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.23E+02	3.08E+01	4.16E+00	4.02E+00	8.04E-02	1.88E+00
			CV3M1	Main Engine - Maneuvering	12	1200	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			CV3AT1	Auxiliary Engines - Transit	2	124	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	5.52E+00	1.32E+00	1.70E-01	1.65E-01	3.19E-03	7.43E-02
			CV3AM1	Auxiliary Engines - Maneuvering	12	1200	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
OSS Installation																		
OSS installation	Heavy lift vessel	OSS Installation Heavy lift vessel	OV1T1	Main Engine - In Transit	2	6	4.13E+02	9.47E+01	1.28E+01	1.24E+01	5.35E-01	5.76E+00	1.92E+03	4.40E+02	5.94E+01	5.74E+01	2.49E+00	2.68E+01
			OV1M1	Main Engine - Maneuvering	24	305	4.98E+01	1.14E+01	1.54E+00	1.49E+00	6.45E-02	6.94E-01						
			OV1AT1	Auxiliary Engines - Transit	2	6	3.09E+01	6.64E+00	8.57E-01	8.30E-01	1.61E-02	3.75E-01	1.24E+03	2.66E+02	3.43E+01	3.32E+01	6.43E-01	1.50E+01
			OV1AM1	Auxiliary Engines - Maneuvering	24	305	5.16E+01	1.11E+01	1.43E+00	1.38E+00	2.68E-02	6.25E-01						
Assisting tug for OSS Jacket and topside install	Tug	OSS Installation Tug	OV2T1	Main Engine - In Transit	2	7	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	6.46E+02	1.55E+02	2.24E+01	2.17E+01	2.24E+00	1.22E+01
			OV2M1	Main Engine - Maneuvering	24	305	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			OV2AT1	Auxiliary Engines - Transit	2	7	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	4.57E+01	1.12E+01	1.45E+00	1.40E+00	2.72E-02	6.34E-01
			OV2AM1	Auxiliary Engines - Maneuvering	24	305	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
OSS Jacket and pilesTransport tug	Tug		OV3T1	Main Engine - In Transit	2	7	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	6.46E+02	1.55E+02	2.24E+01	2.17E+01	2.24E+00	1.22E+01
			OV3M1	Main Engine - Maneuvering	24	218	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			OV3AT1	Auxiliary Engines - Transit	2	7	2.48E+00	6.09E-01	7.86E-02	7.62E-02	1.47E-03	3.44E-02	5.96E+01	1.46E+01	1.89E+00	1.83E+00	3.54E-02	8.25E-01
			OV3AM1	Auxiliary Engines - Maneuvering	24	218	2.48E+00	6.09E-01	7.86E-02	7.62E-02	1.47E-03	3.44E-02						
OSS Jacket Install Noise Mitigation Vessel	OSV	OSS Installation OSV	OV4T1	Main Engine - In Transit	2	7	1.11E+02	2.79E+01	3.76E+00	3.63E+00	7.27E-02	1.70E+00	5.42E+02	1.36E+02	1.84E+01	1.78E+01	3.56E-01	8.30E+00
			OV4M1	Main Engine - Maneuvering	12	44	2.67E+01	6.71E+00	9.05E-01	8.76E-01	1.75E-02	4.09E-01						
			OV4AT1	Auxiliary Engines - Transit	2	7	9.26E+00	2.21E+00	2.85E-01	2.76E-01	5.35E-03	1.25E-01	2.04E+02	4.86E+01	6.27E+00	6.08E+00	1.18E-01	2.74E+00
			OV4AM1	Auxiliary Engines - Maneuvering	12	44	1.54E+01	3.68E+00	4.75E-01	4.60E-01	8.91E-03	2.08E-01						
Acoustic monitoring buoy maint	OSV		OV5T1	Main Engine - In Transit	2	7	4.19E+01	1.05E+01	1.42E+00	1.37E+00	2.74E-02	6.40E-01	2.05E+02	5.15E+01	6.94E+00	6.71E+00	1.34E-01	3.13E+00
			OV5M1	Main Engine - Maneuvering	12	44	1.01E+01	2.54E+00	3.42E-01	3.31E-01	6.61E-03	1.54E-01						
			OV5AT1	Auxiliary Engines - Transit	2	7	2.55E+00	6.09E-01	7.86E-02	7.62E-02	1.47E-03	3.44E-02	3.57E+01	8.53E+00	1.10E+00	1.07E+00	2.06E-02	4.82E-01
			OV5AM1	Auxiliary Engines - Maneuvering	12	44	2.55E+00	6.09E-01	7.86E-02	7.62E-02	1.47E-03	3.44E-02						
OSS Topside Transport (assume separate from Jacket/piles)	Tug	OSS Installation Topside Tug	OV6T1	Main Engine - In Transit	2	7	8.85E+01	2.13E+01	3.07E+00	2.97E+00	3.07E-01	1.67E+00	6.46E+02	1.55E+02	2.24E+01	2.17E+01	2.24E+00	1.22E+01
			OV6M1	Main Engine - Maneuvering	24	87	2.13E+01	5.13E+00	7.39E-01	7.17E-01	7.39E-02	4.03E-01						
			OV6AT1	Auxiliary Engines - Transit	2	7	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02	4.57E+01	1.12E+01	1.45E+00	1.40E+00	2.72E-02	6.34E-01
			OV6AM1	Auxiliary Engines - Maneuvering	24	87	1.91E+00	4.68E-01	6.04E-02	5.85E-02	1.13E-03	2.64E-02						
Refueling operations to OSS and resupply to Hotel vessel	OSV	OSS Installation Refueling OSV	OV7T1	Main Engine - In Transit	2	33	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.83E+02	4.60E+01	6.20E+00	6.00E+00	1.20E-01	2.80E+00
			OV7M1	Main Engine - Maneuvering	24	785	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			OV7AT1	Auxiliary Engines - Transit	2	33	5.13E-01	1.22E-01	1.58E-02	1.53E-02	2.96E-04	6.91E-03	1.23E+01	2.94E+00	3.79E-01	3.67E-01	7.11E-03	1.66E-01
			OV7AM1	Auxiliary Engines - Maneuvering	24	785	5.13E-01	1.22E-01	1.58E-02	1.53E-02	2.96E-04	6.91E-03						
Crew Hotel Vessel	Jack-up vessel	OSS Installation Hotel Jack-up vessel	OV8T1	Main Engine - In Transit	2	15	8.63E+01	1.98E+01	2.67E+00	2.58E+00	1.12E-01	1.20E+00	1.93E+02	4.43E+01	5.97E+00	5.78E+00	2.51E-01	2.70E+00
			OV8M1	Main Engine - Maneuvering	1	245	2.08E+01	4.77E+00	6.42E-01	6.22E-01	2.69E-02	2.90E-01						
			OV8AT1	Auxiliary Engines - Transit	2	15	2.19E+01	4.70E+00	6.07E-01	5.88E-01	1.14E-02	2.65E-01	6.57E+01	1.41E+01	1.82E+00	1.76E+00	3.41E-02	7.96E-01
			OV8AM1	Auxiliary Engines - Maneuvering	1	245	2.19E+01	4.70E+00	6.07E-01	5.88E-01	1.14E-02	2.65E-01						
Inter-Array Cable Installation																		
Array cable transport, pre- lay survey, lay and pull	Cable lay vessel	Array cable lay vessel	IV1T1	Main Engine - In Transit	2	19	9.12E+01	2.11E+01	3.27E+00	3.17E+00	8.17E-01	2.40E+00	6.66E+02	1.54E+02	2.38E+01	2.31E+01	5.96E+00	1.75E+01
			IV1M1	Main Engine - Maneuvering	24	1421	2.20E+01	5.09E+00	7.87E-01	7.64E-01	1.97E-01	5.79E-01						
			IV1AT1	Auxiliary Engines - Transit	2	19	2.14E+01	5.36E+00	6.91E-01	6.70E-01	1.30E-02	3.02E-01	5.13E+02	1.29E+02	1.66E+01	1.61E+01	3.11E-01	7.26E+00
			IV1AM1	Auxiliary Engines - Maneuvering	24	1421	2.14E+01	5.36E+00	6.91E-01	6.70E-01	1.30E-02	3.02E-01						
Pre-lay grapnel run	Multipurpose offshore support vessel	Array offshore support vessel	IV2T1	Main Engine - In Transit	2	7	2.81E+01	6.75E+00	9.73E-01	9.43E-01	9.73E-02	5.31E-01	1.37E+02	3.30E+01	4.76E+00	4.61E+00	4.76E-01	2.60E+00
			IV2M1	Main Engine - Maneuvering	12	124	6.76E+00	1.63E+00	2.34E-01	2.27E-01	2.34E-02	1.28E-01						
			IV2AT1	Auxiliary Engines - Transit	2	7	2.36E+00	5.78E-01	7.46E-02	7.23E-02	1.40E-03	3.26E-02	3.30E+01	8.10E+00	1.04E+00	1.01E+00	1.96E-02	4.57E-01
			IV2AM1	Auxiliary Engines - Maneuvering	12	124	2.36E+00	5.78E-01	7.46E-02	7.23E-02	1.40E-03	3.26E-02						
Crew transfer vessel 1	Crew transfer vessel	Array CTV	IV3T1	Main Engine - In Transit	2	178	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.23E+02	3.08E+01	4.16E+00	4.02E+00	8.04E-02	1.88E+00
			IV3M1	Main Engine - Maneuvering	12	1636	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			IV3AT1	Auxiliary Engines - Transit	2	178	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	5.52E+00	1.32E+00	1.70E-01	1.65E-01	3.19E-03	7.43E-02
			IV3AM1	Auxiliary Engines - Maneuvering	12	1636	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Crew transfer vessel 2	Crew transfer vessel		IV4T1	Main Engine - In Transit	2	178	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.23E+02	3.08E+01	4.16E+00	4.02E+00	8.04E-02	1.88E+00
			IV4M1	Main Engine - Maneuvering	12	1636	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			IV4AT1	Auxiliary Engines - Transit	2	178	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	5.52E+00	1.32E+00	1.70E-01	1.65E-01	3.19E-03	7.43E-02
			IV4AM1	Auxiliary Engines - Maneuvering	12	1636	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Trenching vessel	Purpose-built offshore construction/ROV/s	Array trenching vessel	IV5T1	Main Engine - In Transit	2	7	2.60E+02	6.04E+01	9.33E+00	9.06E+00	2.33E+00	6.86E+00	1.90E+03	4.41E+02	6.81E+01	6.61E+01	1.70E+01	5.01E+01
			IV5M1	Main Engine - Maneuvering	24	1418	6.28E+01	1.46E+01	2.25E+00	2.18E+00	5.62E-01	1.65E+00						
			IV5AT1	Auxiliary Engines - Transit	2	7	1.77E+01	4.43E+00	5.71E-01	5.54E-01	1.07E-02	2.50E-01	7.06E+02	1.77E+02	2.29E+01	2.21E+01	4.29E-01	1.00E+01

Activity	Representative Vessel Type	MDE Form 11 Vessel ID	AERMOD ID	Engine Operation	Daily Operation Hours	Annual Operating Hours - Construction Period	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	VOC (lb/hr)	NOx (lb/day)	CO (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)	SO2 (lb/day)	VOC (lb/day)
	urvey vessel		IV5AM1	Auxiliary Engines - Maneuvering	24	1418	2.94E+01	7.38E+00	9.52E-01	9.23E-01	1.79E-02	4.17E-01						
Guard vessel	Crew transfer vessel	Array guard vessel	IV6T1	Main Engine - In Transit	2	11	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.83E+02	4.60E+01	6.20E+00	6.00E+00	1.20E-01	2.80E+00
			IV6M1	Main Engine - Maneuvering	24	327	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			IV6AT1	Auxiliary Engines - Transit	2	11	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	9.46E+00	2.26E+00	2.91E-01	2.82E-01	5.46E-03	1.27E-01
			IV6AM1	Auxiliary Engines - Maneuvering	24	327	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Offshore Export Cable Installation																		
Offshore export cable pre-lay survey, trenching, cable lay and pull	Cable lay vessel	Export Cable lay vessel	ECV1T1	Main Engine - In Transit	2	6	9.12E+01	2.11E+01	3.27E+00	3.17E+00	8.17E-01	2.40E+00	6.66E+02	1.54E+02	2.38E+01	2.31E+01	5.96E+00	1.75E+01
			ECV1M1	Main Engine - Maneuvering	24	1309	2.20E+01	5.09E+00	7.87E-01	7.64E-01	1.97E-01	5.79E-01						
			ECV1AT1	Auxiliary Engines - Transit	2	6	2.14E+01	5.36E+00	6.91E-01	6.70E-01	1.30E-02	3.02E-01	5.13E+02	1.29E+02	1.66E+01	1.61E+01	3.11E-01	7.26E+00
			ECV1AM1	Auxiliary Engines - Maneuvering	24	1309	2.14E+01	5.36E+00	6.91E-01	6.70E-01	1.30E-02	3.02E-01						
Pre-lay grapnel run & pre-lay survey; post lay survey after completion	Multipurpose offshore support vessel	Export Cable Multipurpose OSV	ECV2T1	Main Engine - In Transit	2	14	2.80E+01	6.49E+00	1.00E+00	9.73E-01	2.51E-01	7.37E-01	2.04E+02	4.73E+01	7.32E+00	7.10E+00	1.83E+00	5.38E+00
			ECV2M1	Main Engine - Maneuvering	24	436	6.74E+00	1.56E+00	2.42E-01	2.34E-01	6.04E-02	1.78E-01						
			ECV2AT1	Auxiliary Engines - Transit	2	14	2.31E+00	5.78E-01	7.46E-02	7.23E-02	1.40E-03	3.26E-02	5.54E+01	1.39E+01	1.79E+00	1.74E+00	3.36E-02	7.84E-01
			ECV2AM1	Auxiliary Engines - Maneuvering	24	436	2.31E+00	5.78E-01	7.46E-02	7.23E-02	1.40E-03	3.26E-02						
Trenching vessel	Purpose built offshore construction/survey vessel	Export Cable Trenching Vessel	ECV3T1	Main Engine - In Transit	2	7	2.60E+02	6.04E+01	9.33E+00	9.06E+00	2.33E+00	6.86E+00	1.90E+03	4.41E+02	6.81E+01	6.61E+01	1.70E+01	5.01E+01
			ECV3M1	Main Engine - Maneuvering	24	1309	6.28E+01	1.46E+01	2.25E+00	2.18E+00	5.62E-01	1.65E+00						
			ECV3AT1	Auxiliary Engines - Transit	2	7	1.77E+01	4.43E+00	5.71E-01	5.54E-01	1.07E-02	2.50E-01	7.06E+02	1.77E+02	2.29E+01	2.21E+01	4.29E-01	1.00E+01
			ECV3AM1	Auxiliary Engines - Maneuvering	24	1309	2.94E+01	7.38E+00	9.52E-01	9.23E-01	1.79E-02	4.17E-01						
HDD pull in lift vessel	Jack-up vessel	Export Cable HDD Lift Vessel	ECV4T1	Main Engine - In Transit	2	15	8.63E+01	1.98E+01	2.67E+00	2.58E+00	1.12E-01	1.20E+00	1.73E+02	3.96E+01	5.33E+00	5.16E+00	2.24E-01	2.41E+00
			ECV4M1	Main Engine - Maneuvering	12	305	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
			ECV4AT1	Auxiliary Engines - Transit	2	15	2.19E+01	4.70E+00	6.07E-01	5.88E-01	1.14E-02	2.65E-01	3.07E+02	6.58E+01	8.49E+00	8.23E+00	1.59E-01	3.72E+00
			ECV4AM1	Auxiliary Engines - Maneuvering	12	305	2.19E+01	4.70E+00	6.07E-01	5.88E-01	1.14E-02	2.65E-01						
Diving support for HDD pull in	Research / Survey	Export Cable HDD pull in Vessel	ECV5T1	Main Engine - In Transit	2	6	1.41E+01	3.23E+00	4.88E-01	4.73E-01	9.47E-02	3.16E-01	6.92E+01	1.58E+01	2.39E+00	2.32E+00	4.63E-01	1.54E+00
			ECV5M1	Main Engine - Maneuvering	12	305	3.41E+00	7.78E-01	1.18E-01	1.14E-01	2.28E-02	7.60E-02						
			ECV5AT1	Auxiliary Engines - Transit	2	6	2.61E+00	6.35E-01	8.19E-02	7.93E-02	1.54E-03	3.58E-02	3.66E+01	8.89E+00	1.15E+00	1.11E+00	2.15E-02	5.02E-01
			ECV5AM1	Auxiliary Engines - Maneuvering	12	305	2.61E+00	6.35E-01	8.19E-02	7.93E-02	1.54E-03	3.58E-02						
HDD pull in support vessel	Multipurpose offshore support vessel	Export Cable pull in support vessel	ECV6T1	Main Engine - In Transit	2	85	2.80E+01	6.49E+00	1.00E+00	9.73E-01	2.51E-01	7.37E-01	1.37E+02	3.17E+01	4.90E+00	4.76E+00	1.23E+00	3.60E+00
			ECV6M1	Main Engine - Maneuvering	12	305	6.74E+00	1.56E+00	2.42E-01	2.34E-01	6.04E-02	1.78E-01						
			ECV6AT1	Auxiliary Engines - Transit	2	85	2.31E+00	5.78E-01	7.46E-02	7.23E-02	1.40E-03	3.26E-02	3.23E+01	8.10E+00	1.04E+00	1.01E+00	1.96E-02	4.57E-01
			ECV6AM1	Auxiliary Engines - Maneuvering	12	305	2.31E+00	5.78E-01	7.46E-02	7.23E-02	1.40E-03	3.26E-02						
Activity	**Representative Vessel Type**	**Representative Vessel Type**	**AERMOD ID**	**Engine Operation**	**Daily Operation Hours**	**Annual Operating Hours - Operation**	**NOx (lb/hr)**	**CO (lb/hr)**	**PM10 (lb/hr)**	**PM2.5 (lb/hr)**	**SO2 (lb/hr)**	**VOC (lb/hr)**	**NOx (lb/day)**	**CO (lb/day)**	**PM10 (lb/day)**	**PM2.5 (lb/day)**	**SO2 (lb/day)**	**VOC (lb/day)**
Operations Phase																		
Scour protection repair	Fallpipe vessel	Operation Scour Protection Repair Vessel	OMV1T1	Main Engine - In Transit	2	4	2.34E+02	5.43E+01	8.40E+00	8.15E+00	2.10E+00	6.18E+00	1.71E+03	3.97E+02	6.13E+01	5.95E+01	1.53E+01	4.51E+01
			OMV1M1	Main Engine - Maneuvering	24	7	5.65E+01	1.31E+01	2.02E+00	1.96E+00	5.06E-01	1.49E+00						
			OMV1AT1	Auxiliary Engines - Transit	2	4	2.90E+00	7.26E-01	9.37E-02	9.08E-02	1.76E-03	4.10E-02	2.83E+02	7.09E+01	9.14E+00	8.86E+00	1.71E-01	4.00E+00
			OMV1AM1	Auxiliary Engines - Maneuvering	24	7	1.18E+01	2.95E+00	3.81E-01	3.69E-01	7.14E-03	1.67E-01						
Refueling operations to OSS	Crew transfer vessel	Operation Refueling Vessel	OMV2T1	Main Engine - In Transit	2	26	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.83E+02	4.60E+01	6.20E+00	6.00E+00	1.20E-01	2.80E+00
			OMV2M1	Main Engine - Maneuvering	24	10	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			OMV2AT1	Auxiliary Engines - Transit	2	26	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	9.46E+00	2.26E+00	2.91E-01	2.82E-01	5.46E-03	1.27E-01
			OMV2AM1	Auxiliary Engines - Maneuvering	24	10	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						
Main repair vessel	Jack-up vessel	Operation Main Repair Vessel	OMV3T1	Main Engine - In Transit	2	8	8.63E+01	1.98E+01	2.67E+00	2.58E+00	1.12E-01	1.20E+00	1.73E+02	3.96E+01	5.33E+00	5.16E+00	2.24E-01	2.41E+00
			OMV3M1	Main Engine - Maneuvering	24	109	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00						
			OMV3AT1	Auxiliary Engines - Transit	2	8	2.19E+01	4.70E+00	6.07E-01	5.88E-01	1.14E-02	2.65E-01	5.26E+02	1.13E+02	1.46E+01	1.41E+01	2.73E-01	6.37E+00
			OMV3AM1	Auxiliary Engines - Maneuvering	24	109	2.19E+01	4.70E+00	6.07E-01	5.88E-01	1.14E-02	2.65E-01						
Ad hoc survey workand cable survey/inspections	Multi-role survey vessel	Operation survey vessel	OMV4T1	Main Engine - In Transit	2	22	1.41E+01	3.23E+00	4.88E-01	4.73E-01	9.47E-02	3.16E-01	1.03E+02	2.36E+01	3.56E+00	3.46E+00	6.91E-01	2.30E+00
			OMV4M1	Main Engine - Maneuvering	24	38	3.41E+00	7.78E-01	1.18E-01	1.14E-01	2.28E-02	7.60E-02						
			OMV4AT1	Auxiliary Engines - Transit	2	22	2.61E+00	6.35E-01	8.19E-02	7.93E-02	1.54E-03	3.58E-02	6.27E+01	1.52E+01	1.97E+00	1.90E+00	3.69E-02	8.60E-01
			OMV4AM1	Auxiliary Engines - Maneuvering	24	38	2.61E+00	6.35E-01	8.19E-02	7.93E-02	1.54E-03	3.58E-02						
Cable burial repair	Multi-role survey vessel		OMV5T1	Main Engine - In Transit	2	14	1.41E+01	3.23E+00	4.88E-01	4.73E-01	9.47E-02	3.16E-01	1.03E+02	2.36E+01	3.56E+00	3.46E+00	6.91E-01	2.30E+00
			OMV5M1	Main Engine - Maneuvering	24	48	3.41E+00	7.78E-01	1.18E-01	1.14E-01	2.28E-02	7.60E-02						
			OMV5AT1	Auxiliary Engines - Transit	2	14	2.61E+00	6.35E-01	8.19E-02	7.93E-02	1.54E-03	3.58E-02	6.27E+01	1.52E+01	1.97E+00	1.90E+00	3.69E-02	8.60E-01
			OMV5AM1	Auxiliary Engines - Maneuvering	24	48	2.61E+00	6.35E-01	8.19E-02	7.93E-02	1.54E-03	3.58E-02						
Daily crew transfer vessel	Crew transfer vessel #1	Operation CTVs	OMV6T1	Main Engine - In Transit	2	475	4.93E+00	6.30E+00	1.10E-01	1.10E-01	1.64E-02	5.21E-01	3.60E+01	4.60E+01	8.01E-01	8.01E-01	1.20E-01	3.80E+00
			OMV6M1	Main Engine - Maneuvering	24	4380	1.19E+00	1.52E+00	2.64E-02	2.64E-02	3.96E-03	1.25E-01						
			OMV6AT1	Auxiliary Engines - Transit	2	475	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03	5.28E+00	2.26E+00	1.37E-01	1.37E-01	5.46E-03	1.27E-01
			OMV6AM1	Auxiliary Engines - Maneuvering	24	4380	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03						
Daily crew transfer vessel	Crew transfer vessel #2		OMV7T1	Main Engine - In Transit	2	475	4.93E+00	6.30E+00	1.10E-01	1.10E-01	1.64E-02	5.21E-01	3.60E+01	4.60E+01	8.01E-01	8.01E-01	1.20E-01	3.80E+00
			OMV7M1	Main Engine - Maneuvering	24	4380	1.19E+00	1.52E+00	2.64E-02	2.64E-02	3.96E-03	1.25E-01						
			OMV7AT1	Auxiliary Engines - Transit	2	475	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03	5.28E+00	2.26E+00	1.37E-01	1.37E-01	5.46E-03	1.27E-01
			OMV7AM1	Auxiliary Engines - Maneuvering	24	4380	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03						
Daily crew transfer vessel	Crew transfer vessel #3		OMV8T1	Main Engine - In Transit	2	475	4.93E+00	6.30E+00	1.10E-01	1.10E-01	1.64E-02	5.21E-01	3.60E+01	4.60E+01	8.01E-01	8.01E-01	1.20E-01	3.80E+00
			OMV8M1	Main Engine - Maneuvering	24	4380	1.19E+00	1.52E+00	2.64E-02	2.64E-02	3.96E-03	1.25E-01						
			OMV8AT1	Auxiliary Engines - Transit	2	475	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03	5.28E+00	2.26E+00	1.37E-01	1.37E-01	5.46E-03	1.27E-01
			OMV8AM1	Auxiliary Engines - Maneuvering	24	4380	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03						
Daily crew transfer vessel	Crew transfer vessel #4		OMV9T1	Main Engine - In Transit	2	475	4.93E+00	6.30E+00	1.10E-01	1.10E-01	1.64E-02	5.21E-01	3.60E+01	4.60E+01	8.01E-01	8.01E-01	1.20E-01	3.80E+00
			OMV9M1	Main Engine - Maneuvering	24	4380	1.19E+00	1.52E+00	2.64E-02	2.64E-02	3.96E-03	1.25E-01						
			OMV9AT1	Auxiliary Engines - Transit	2	475	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03	5.28E+00	2.26E+00	1.37E-01	1.37E-01	5.46E-03	1.27E-01

Activity	Representative Vessel Type	MDE Form 11 Vessel ID	AERMOD ID	Engine Operation	Daily Operation Hours	Annual Operating Hours - Construction Period	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	SO2 (lb/hr)	VOC (lb/hr)	NOx (lb/day)	CO (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)	SO2 (lb/day)	VOC (lb/day)
			OMV9AM1	Auxiliary Engines - Maneuvering	24	4380	2.20E-01	9.40E-02	5.69E-03	5.69E-03	2.28E-04	5.31E-03						
Environmental monitoring Vessel	Sportfisher	Operation Environmental Monitoring Vessel	OMV10T1	Main Engine - In Transit	2	325	2.51E+01	6.30E+00	8.50E-01	8.22E-01	1.64E-02	3.84E-01	1.83E+02	4.60E+01	6.20E+00	6.00E+00	1.20E-01	2.80E+00
			OMV10M1	Main Engine - Maneuvering	24	48	6.04E+00	1.52E+00	2.05E-01	1.98E-01	3.96E-03	9.25E-02						
			OMV10AT1	Auxiliary Engines - Transit	2	325	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03	9.46E+00	2.26E+00	2.91E-01	2.82E-01	5.46E-03	1.27E-01
			OMV10AM1	Auxiliary Engines - Maneuvering	24	48	3.94E-01	9.40E-02	1.21E-02	1.18E-02	2.28E-04	5.31E-03						

Appendix D
MDE Environmental Justice Score Report and Applicable Zoning Requirements

1.0 APPLICABLE ZONING REQUIREMENTS

Under Md. Code, Env't. § 2-404(b)(1), the Maryland Department of the Environment (MDE) cannot accept an application for a permit unless the applicant submits documentation that shows either: (i) the proposal has been approved by the local jurisdiction for all zoning and land use requirements; or (ii) the source meets all applicable zoning and land use requirements.

Here, for the reasons discussed below, there are no "applicable zoning and land use requirements" for the activities that will be covered by the Clean Air Act permit because the activities subject to the permit are located offshore. As a result, US Wind's application satisfies Md. Code, Env't. § 2-404(b)(1). Furthermore, the law does not require that US Wind provide documentation showing that local jurisdictions concur with this determination. As explained by the D.C. Circuit, Section 2-404(b)(1)(ii) "expressly permits [an] applicant to avoid involvement by the local zoning authority altogether," if the applicant can demonstrate independently that the source can meet all applicable zoning and land use requirements, as US Wind has done here. *Dominion Transmission, Inc. v. Summers*, 723 F.3d 238, 245 (D.C. Cir. 2013) (emphasis added).

An Outer Continental Shelf (OCS) source is defined as any equipment, activity, or facility which (1) emits or has the potential to emit any air pollutant; (2) is regulated or authorized under the OCSLA [Outer Continental Shelf Lands Act]; and (3) is located on the OCS or in or on waters above the OCS. 40 C.F.R. § 55.2. In the case of offshore wind, the sources are construction vessels, emissions from offshore substations (OSSs) at certain stages, and operations and maintenance (O&M) vessels or other activity at the wind turbine generators (WTGs) or OSSs. The zoning regulations of Worcester County and Ocean City, Maryland, apply to onshore sources, but cannot apply to sources in the OCS because an OCS source must be located "on the OCS or in or on waters above the OCS." The Clean Air Act regulates "OCS sources" and those are distinct from onshore, land use activities.

1.1 Worcester County, Maryland

Worchester County Zoning and Subdivision Article Code § ZS 1-107 is not applicable to sources on the OCS associated with the project. The applicability is limited to only those lands within the County. While it does reference "submerged lands," the project will not be located on submerged lands within the County. The Submerged Lands Act only grants coastal states title to waters and submerged lands out to three nautical miles. *See* 43 U.S.C. §§ 1301-1315. The project will be located approximately 10 nautical miles from the Maryland coast in the OCS where the County has no jurisdictional authority.

In addition, Worcester County would not be able to apply its zoning requirements based on provision § ZS 1-107(b) regarding Federal lands. The OCSLA establishes that federal law applies on the OCS as if it "were an area of exclusive Federal jurisdiction located within a State." 43 U.S.C. § 1333(a)(1)-(2). State and local laws are applicable only to the extent they are "applicable" and "not inconsistent" with federal law. 43 U.S.C. § 1333(a)(2)(A). Again, the zoning rules are not applicable because the Clean Air Act permit is for an OCS source, not a source within the County. If the zoning code did apply, it would arguably be inconsistent with the OCSLA, which authorizes the U.S. Department of the Interior to make decisions regarding the management and use of the OCS.

In contrast, as part of the offshore wind project, US Wind is seeking a permit for the construction of an O&M facility in West Ocean City, an unincorporated municipality in Worcester County. Construction of the facility is subject to Worcester County and state regulations due to its location onshore and is distinct from the OCS sources regulated under the Clean Air Act permit. US Wind initiated the state permitting activities for the O&M facility on August 30, 2023, with a Joint Permit Application to MDE and the U.S. Army Corps of Engineers. Thus, there is no gap in regulation for facilities (both onshore and the OCS) associated with the US Wind project as the federal, state, and local regulatory regimes complement each other.

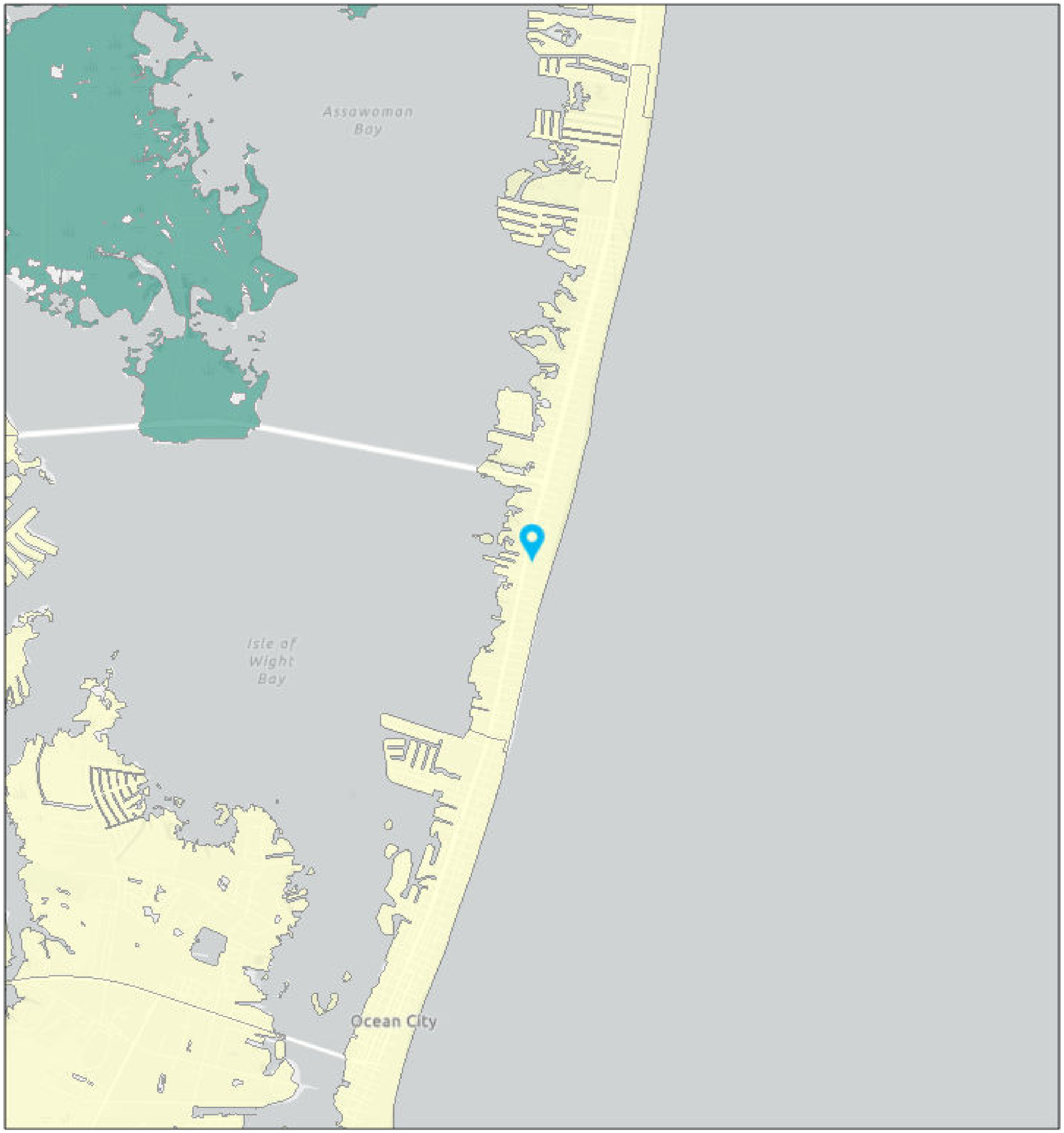
1.2 Ocean City, Maryland

Chapter 110, Zoning, of the Ocean City, Maryland, Code of Ordinances is similarly inapplicable to the OCS sources associated with the project for the reasons described above in Appendix D, Section 1.1. Namely, the requirements apply to land within Ocean City and do not apply to sources on the OCS.

MDE Screening Report

Area of Interest (AOI) Information

Oct 2 2023 10:04:05 Eastern Daylight Time



1:72,224

MDE Final EJ Score (%ile score)

- 0% - 24.9th %ile
- 25% - 49.9th %ile
- 50% - 74.9th %ile
- 75% - 100th %ile

0 0.5 1 2 mi

0 0.75 1.5 3 km

MDE, OS, OIMT, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Summary

Name	Count	Area(mi²)	Length(mi)
MDE Final EJ Score (%ile score)	1	N/A	N/A
Overburdened Communities Combined Score	1	N/A	N/A
Overburdened Pollution Environmental Score (%ile score)	1	N/A	N/A
Overburdened Exposure Score (%ile score)	1	N/A	N/A
Overburdened Sensitive Population (%ile score)	1	N/A	N/A
Socioeconomic/Demographic Score 2020 (Percentile score) (Underserved Community)	1	N/A	N/A
Air Emissions Facilities	0	N/A	N/A
Sulfur Dioxide (2010)	0	N/A	N/A
Ozone (2015)	1	N/A	N/A
Fine Particles (2012)	1	N/A	N/A
Biosolids FY 2020 and Current Permit Details	0	N/A	N/A
Biosolids FY2010 - 2014 Permit Details	0	N/A	N/A
Biosolids FY2009 Expired Permit Details	0	N/A	N/A
Biosolids FY 2020 and Current Permits Distribution By Acreage	0	N/A	N/A
Biosolids FY2015 - 2019 Permits Distribution By Acreage	1	N/A	N/A
Biosolids FY2010 - 2014 Permits Distribution By Acreage	1	N/A	N/A
Biosolids FY2009 Permits Expired Distribution By Acreage	1	N/A	N/A
Biosolids FY 2020 and Current Permit Distribution By Percent Coverage	1	N/A	N/A

Biosolids FY2015 - 2019 Permit Distribution By Percent Coverage	1	N/A	N/A
Biosolids FY2010 - 2014 Permit Distribution By Percent Coverage	1	N/A	N/A
Biosolids FY2009 Expired Permit Distribution By Percent Coverage	1	N/A	N/A
Concentrated Animal Feeding Operations (CAFOs)	0	N/A	N/A
Composting Facilities	0	N/A	N/A
Food Scrap Acceptors	0	N/A	N/A
Landfills	0	N/A	N/A
Correctional Facilities	0	N/A	N/A
Industrial Food Suppliers	0	N/A	N/A
Residential Colleges	0	N/A	N/A
Non-Residential Colleges	0	N/A	N/A
Hospitals	0	N/A	N/A
High Schools	0	N/A	N/A
Grocery Stores	0	N/A	N/A
10 Miles from Landfill	1	N/A	N/A
10 Miles from Composting Facility	0	N/A	N/A
General Composting Facilities Tier 2 (MD)	0	N/A	N/A
Commercial Anaerobic Digester (MD)	0	N/A	N/A
Out of State Facilities	0	N/A	N/A
30 mile buffer (Maryland)	0	N/A	N/A
30 Mile Buffer (Out of State)	1	N/A	N/A
Land Restoration Facilities	0	N/A	N/A
Determinations (points)	0	N/A	N/A
Determinations (areas)	0	N/A	N/A

Entities	0	N/A	N/A
Active Coal Mine Sites	0	N/A	N/A
Historic Mine Facilities	0	N/A	N/A
All Permitted Solid Waste Acceptance Facilities	0	N/A	N/A
Municipal Solid Waste Acceptance Facilities	0	N/A	N/A
Maryland Dam Locations	0	N/A	N/A
Maryland Pond Locations	0	N/A	N/A
Surface Water Intakes	0	N/A	N/A
Wastewater Discharge Facilities	0	N/A	N/A
Drinking Water	0	N/A	N/A
Clean Water	0	N/A	N/A

MDE Final EJ Score (%ile score)

#	Census tract identifier	Geographic Area Name	Total Population	Final EJ Score Percent (for this tract)	Final EJ Score Percentile (Distribution across Maryland)	Area(mi²)
1	24047950100	Census Tract 9501, Worcester County, Maryland	2232	23.21	17.29	N/A

Overburdened Communities Combined Score

#	GEOID20	Geographic_Area_Name	TotalPop	Overburd_Exposure_Percent	Overburd_Exposure_Percentile
1	24047950100	Census Tract 9501, Worcester County, Maryland	2,232	36.26	5.06

#	Overburd_Poll_Enviro_Percent	Overburd_Poll_Enviro_Percentile	Sensitive_Population_Percent	Sensitive_Population_Percentile	OverburdenedAllPercent	OverburdenedAllPercentile	Area(mi²)
1	5.12	33.83	61.66	54.68	28.57	18.66	N/A

Overburdened Pollution Environmental Score (%ile score)

#	GEOID20	Geographic_Area_Name	RentalsOccupiedPre79Percent	Percentile	PercentRMP
1	24047950100	Census Tract 9501, Worcester County, Maryland	16.77	51.67	25.40

#	PercentRMPEJ	PercentHazWaste	PercentHazWasteEJ	PercentSuperFundNPL	PercentSuperFundNPLEJ
1	13.57	1.38	6.09	2.55	5.38

#	PercentHazWW	PercentHazWWEJ	BrownFPercent	Percentile_1	PercentPowerPlants
1	0.00	0.00	0.00	0.00	0.00

#	Percentile_12	PercentCAFOS	Percentile_12_13	PercentActiveMines	Percentile_12_13_14
1	0.00	0.00	0.00	0.00	0.00

#	PollutionEnvironmentalPercent	PollnEnvironmentalPercentile	Area(mi²)
1	5.12	33.83	N/A

Overburdened Exposure Score (%ile score)

#	GEOID20	Geographic_Area_Name	Total_Pop	PercentNATA_Cancer	Percentile_NATA_Cancer
1	24047950100	Census Tract 9501, Worcester County, Maryland	2,232.00	40.00	5.12

#	PercentNATA_Resp_HI	Percentile_NATA_Resp_HI	PercentNATA_Diesel	Percentile_NATA_Diesel	PercentNATA_PM25
1	40.00	2.84	13.92	4.27	75.95

#	PercentileNATA_PM25	PercentOzone	PercentileOzone	PercentTraffic	PercentileTraffic
1	2.43	88.96	7.40	14.58	13.72

#	PercentTRI	PercentileTRI	PercentHazWasteLF	Percentile_HazWasteLF	PollutionExposurePercent	PollutionExposurePercentile	Area(mi²)
1	0.00	0.00	16.67	95.49	36.26	5.06	N/A

Overburdened Sensitive Population (%ile score)

#	GEOID20	Geographic_Area_Name	PerAstma	PercentileAst	PerMyo
1	24047950100	Census Tract 9501, Worcester County, Maryland	78.80	48.94	80.40

#	PercentileMyo	PerLow	PercentileLow	PercentBroad	PercentileBroad
1	47.78	0.00	0.00	11.79	48.53

#	PercentSens	PercentileSens	Area(mi²)
1	42.75	36.33	N/A

Socioeconomic/Demographic Score 2020 (Percentile score) (Underserved Community)

#	Census tract identifier	Geographic Area Name	Total Population	Percent Poverty	Percent Minority
1	24047950100	Census Tract 9501, Worcester County, Maryland	2,232	18.95	7.12

#	Percent Limited English Proficiency	Demographic Score (Percent for this tract)	Demographic Score (Percentile Distribution acoss Maryland)	Area(mi²)
1	0.00	8.69	12.82	N/A

Ozone (2015)

#	STATEFP10	COUNTYFP10	COUNTYNS10	GEOID10	NAME10
1	24	047	01668802	24047	Worcester

#	Ozone NAA Area	8-Hr Ozone (2015) Designation	8-HR Ozone (2015) Classification	8-Hr Ozone (2015) Status	Area(mi²)
1	*No Data*	Attainment/Unclassifiable	*No Data*	*No Data*	N/A

Fine Particles (2012)

#	STATEFP10	COUNTYFP10	COUNTYNS10	GEOID10	NAME10	PM2.5 (2012) Status	Area(mi²)
1	24	047	01668802	24047	Worcester	Attainment/Unclassifiable	N/A

Biosolids FY2015 - 2019 Permits Distribution By Acreage

#	County Name	FY2015to2019	Area(mi²)
1	Worcester	*No Data*	N/A

Biosolids FY2010 - 2014 Permits Distribution By Acreage

#	County Name	FY2010to2014	Area(mi²)
1	Worcester	*No Data*	N/A

Biosolids FY2009 Permits Expired Distribution By Acreage

#	County Name	FY2009	Area(mi²)
1	Worcester	*No Data*	N/A

Biosolids FY 2020 and Current Permit Distribution By Percent Coverage

#	County Name	FY2020andAfter	Area(mi²)
1	Worcester	*No Data*	N/A

Biosolids FY2015 - 2019 Permit Distribution By Percent Coverage

#	County Name	FY2015to2019	Area(mi²)
1	Worcester	*No Data*	N/A

Biosolids FY2010 - 2014 Permit Distribution By Percent Coverage

#	County Name	FY2010to2014	Area(mi²)
1	Worcester	*No Data*	N/A

Biosolids FY2009 Expired Permit Distribution By Percent Coverage

#	County Name	FY2009	Area(mi²)
1	Worcester	*No Data*	N/A

10 Miles from Landfill

#	County	Type	Facility_N	ADDRESS	FILL
1	WORCESTER	WTS	Ocean City TransferStation	306 65th Ocean City MD 21842.	-

#	SITE__ACRE	AI_No_	Owner_Type	MD_GRID__E	PERMITNUMB	EXPIRATION	Area(mi²)
1	2.20	37,444.00	MUN	1353 /207	2015-WTS-0156	6/6/2020, 8:00 PM	N/A

30 Mile Buffer (Out of State)

#	FacilityName	Contact	Area(mi²)
1	Blue Hen Organics	http://www.bluehenorganics.com/	N/A

Appendix E
Proposed Testing, Monitoring, Record Keeping, and Reporting

1.0 PROPOSED OPERATING REQUIREMENTS AND WORK PRACTICES

1.1 Non-Emergency Diesel Engines Located on OSS

1. For the non- emergency engine located on the OSS during the construction and operational phases, US Wind will install, operate, and maintain all engines to achieve the emissions standards at 40 C.F.R. § 60.4204(b) over the entire life of the engine.

2. US Wind will ensure that the diesel fuel purchased for and used in each Engine meets a sulfur content of 15 parts per million (ppm) by weight maximum.

3. US Wind will install and operate all engines that are certified by the manufacturer to meet or surpass the emission standards in 40 C.F.R. § 60.4204(b).

4. US Wind will meet the following requirements:
   i) Install, operate and maintain all Engines and control devices according to the manufacturer's emission-related written instructions;
   ii) Only change emission-related settings on the Engines that are permitted by the manufacturer; and
   iii) Install and operate the Engines configured according to the manufacturer's emission-related specifications.

1.2 Marine Engines on Vessels when Operating as OCS Source

1. All OCS vessel engines will comply with the operating and work practice standards, as applicable, specified in 40 C.F.R. Part 60, Subpart IIII and 40 C.F.R. Part 63, Subpart ZZZZ.

2.0 PROPOSED TESTING PLAN

2.1 Testing Requirements

1. US Wind will, upon request by the MDE, conduct emission test(s), including visible emissions, of any operating emission unit subject to an emission limit in the permit, including any engine on any vessel while that vessel is an OCS source. US Wind will perform the tests using the procedures and reference in 40 C.F.R. Part 60, Appendix A, as applicable.

3.0 PROPOSED RECORD KEEPING PLAN

3.1 Record Keeping Requirements

1. US Wind will keep records of all required information necessary to submit annual Emissions Statements to the MDE, as required.

2. US Wind will maintain records as listed below. These records should be retained for a period of at least five years from the date of recording, inspection, testing, or repair, and be made available to MDE representatives upon request. The records will be maintained during construction, commissioning, and operation activities.

   a. For all engines operating on OCS sources (including engines on vessels meeting the definition of an OCS source), US Wind will keep the following records:

      (1) the name of the vessel and engines;

      (2) the daily fuel consumption of Marine Fuel or ULSD for each vessel and/or engine (i.e., starting and ending fuel volume per each operating day taking into consideration any refueling). This record is only required if US Wind uses fuel use as a surrogate to power used for purposes of documenting actual engine load when operating.

      (3) the name of the fuel supplier; Permittee shall keep records for each supplier (if multiple refueling operations with different suppliers are utilized);

      (4) the sulfur content of the fuel;
         (a) the method used to determine the sulfur content of the fuel (compliance may be shown by supplier's receipt at refueling indicating % sulfur content); and
         (b) the location of the fuel when the sample was drawn for analysis to determine the sulfur content of the fuel; specifically including whether the fuel was sampled as delivered to the emission sources.

      (5) The date and time that a vessel becomes an OCS source during the construction, commissioning, and operational phases.

      (6) The date and time that a vessel ceases to be an OCS source during the construction, commissioning, and operational phases.

      (7) The make, model, maximum rated power output, cylinder size, and manufacturing date of each engine on each vessel operating as an OCS source

during the construction phase, including if the vessel is a domestic or foreign-flagged vessel.

(8) The make, model, maximum rated power output, cylinder size, and manufacturing date of each engine on each vessel included in the PTE during the operational phase, including if the vessel is a domestic or foreign-flagged vessel.

(9) The make, model, maximum rated power output, cylinder size, and manufacturing date of each engine on each OSS.

(10) Copies of certifications that demonstrate the Tier standard the engine was manufactured to meet for each engine on each vessel that meets the definition of an OCS source. The different Tier standards are found in 40 C.F.R. Parts 89, 1042 – Appendix I (formerly part 94), 1039, or 1042. For foreign flagged vessels the different Tier standards are found at Regulation 13 of MARPOL Annex VI.

b. For each engine on each vessel that is included in the PTE during the operational phase of the project, record daily, for each and every day, the:

(1) Total hours of operation when operating within 25 nautical miles of the OCS source;

(2) Engine speed rating, in rpms (if applicable in determining daily emissions);

(3) Emission factor associated with the engine certification, or the emission factor specified in item 3.1(2)(d), as applicable, used in determining the daily emissions required; and

(4) Actual fuel usage data and manufacturing load and fuel consumption rate information, if engine load is determined by using the formula for determining a daily load factor in item 3.1(2)(d).

c. Beginning on the "operational start date," defined as the date US Wind identifies in its notice to BOEM, pursuant to 30 C.F.R. § 585.636, that the windfarm will commence commercial operations, US Wind will start recording on a daily basis for each and every day, the total amount (in tons) of NO_x emissions emitted from:

(1) engines on any OSS;
(2) all engines on vessels included in the definition of an OCS source: and
(3) all engines on vessels servicing or associated with the work area when those vessels are at the work area, or en route to or from the work area and are within 25 nautical miles of the work area centroid.

d. Daily emissions for vessels shall be calculated using the following formula:

$E = kW * Hours * LF * EF * 1.10231E\text{-}6$

Where:

E = total emissions, tons

- kW = total engine size, kW
- Hours = hours for each engine
- LF = engine load factor
- EF = emission factor, g/kW-hr
- 1.10231E-6 = g to ton conversion factor

When determining the values for the above variables, US Wind will use the following:

(1) The engine load factor should be calculated using actual fuel usage data, engine operating time, manufacturing load and fuel consumption rate information, and the following formula:

Where:

$LF = V \div T \div Rmax$

- LF = engine load factor
- V = volume fuel consumed during engine operation, gal
- T = engine operating time, hours
- Rmax = fuel consumption rate at maximum engine power, gal/hr

Alternatively, if actual fuel usage data is not available, US Wind may use an engine load factor of 0.69. This number is based on the weighted average engine load when a manufacturer certified an engine meets EPA's Tier emission limits (40 C.F.R. Part 94.105(b), Table B and 40 C.F.R. Part 1042, Appendix II, section (a)(1)).

(2) For domestically flagged vessels, the emission factor shall be the NO_x and HC emission rate for the Tier level the engine has been certified to meet. If the Tier level combines both NO_x and either HC or THC into one emission limit, then that emission limit shall be multiplied by 0.976 for NOx. The emission rates are contained in 40 C.F.R. Part 1042.101 or 1042 – Appendix I and vary depending on the engine's Tier classification. For engines on domestically flagged vessels without a Tier certification the emission factors shall be the following:

(a) For Category 1 engines 9.7 g/kW-hr for NO_x and 0.52 g/kW-hr for VOC.
(b) For Category 2 engines 16.5 g/kW-hr for NO_x and 0.5 g/kW-hr for VOC.
(c) For Category 3 engines 19.5 g/kW-hr for NO_x and emission factors for VOC in

item 3 below.

(3) For foreign flagged vessels, the emission factor for NO_x shall be the emission rate for the Tier level engine in Table 3(a) below. For foreign flagged vessels, the emission factor for NOx shall be the emission rate for the Tier level engine in Table 2 of this permit. For category 3 engines and foreign flagged vessels without Annex VI certifications, the emission factor shall be 19.5 g/kW-hr for NOx and Table 3(b) emission factors for VOC below. There are several different emission factors for VOC emissions depending on an engine's purpose and type of vessel with which it is associated.

Table 3(a):

Annex VI/EPA Tier	Ship constructed after	Total weighted cycle NO_x emission limit (g/kWh) n = engine's rated speed (rpm)		
		n is less than 130	n –is 130 or more but less than 2,000	n is 2000 or
I / 1	January 2000[a]	17.0	$45 \cdot n^{(-0.2)}$ e.g., 720 rpm = 12.1	9.8
II / 2	January 2011	14.4	$44 \cdot n^{(-0.23)}$ e.g., 720 rpm = 9.7	7.7
III / 3	January 2016	3.4	$9 \cdot n^{(-0.2)}$ e.g., 720 rpm = 2.4	2.0[b]

a: The EPA Tier 1 NO_x emission limits for Category 3 engines on U.S. apply beginning model year 2004;however, the Annex VI Tier I standards apply to engines installed on U.S. vessels beginning 1 January 2000 if that U.S. vessel operates internationally.

b: The total weighted cycle NO_x emission limit for engines meeting the Annex VI Tier III standard is 1.96 when the engine speed equals or exceeds 2,000 rpm

Table 3(b):

Engine or Vessel Type	VOC Emissions (g/kW-hr)
Auxiliary engines on all vessel types	0.14
Tugboats	0.18
All types of jack-up vessels	0.14
Supply vessels	0.17
All cable laying vessels	0.24
All other vessel types	0.14

(4) Each time US Wind uses a vessel while operating as an OCS source with a lower Tier certified engine, record the condition that US Wind relied on to justify the use of a vessel with a lower Tier certified engine under. US Wind will record

information necessary to justify one of the two following conditions in order to use a lesser Tier engine:

(a) A vessel with a higher Tier engine is not available within two hours of when the vessel must be deployed;
(b) The total emissions associated with the use of a vessel with the higher Tier engine(s) would be greater than the total emissions associated with the use of the vessel with the next lower Tier engine(s). When determining the total emissions associated with the use of a vessel with a particular engine, US Wind may include the emissions of the vessel that would occur when the vessel would be going to the WDA from the vessel's starting location.

4.0 PROPOSED REPORTING PLAN

4.1 Reporting Requirements

1. US Wind will notify the MDE, in writing, at least 30 days, but no more than 90 days, prior to locating the first OCS source.

2. US Wind will notify the MDE, in writing, at least 30 days prior to installing and/or operating an Engine on each OSS. The notification will include the make, model, maximum rated power output, cylinder size, and manufacturing date.

3. US Wind will hold at its onshore office, all records required by the permit, including, but not limited to, monitoring data and support information required by the permit, and records of all data used to complete the application for the permit. These materials will be retained for at least five years from the date of the sample, measurement, or report.

4. US Wind will comply with the requirements specified in the following parts of the New Source Performance Standards, Subpart A (General Provisions): 40 C.F.R. §§ 60.1 through 60.6, 60.9, 60.10, 60.12, 60.14 through 60.17, and 60.19, as specified in Table 8 of 40 C.F.R. part 60, subpart IIII (Standards of Performance for Stationary Compression Ignition (CI) Internal Combustion Engines (ICE)).

5. US Wind will demonstrate that any NO_x ERCs used for compliance are surplus, quantifiable, enforceable, and permanent. US Wind will submit the demonstration to the MDE prior to the Operational Phase Start Date. The demonstration will include, at a minimum, 1) the source where the ERCs were generated; and 2) the time period used to determine the ERCs.

Annual Emissions Statements

6. US Wind will submit annual Emissions Statements to the MDE, as required.

Quarterly Compliance and Permit Deviation Reports

7. US Wind will submit annually by January 31, April 30, July 31, and October 31 for the previous three months respectively, a report to the MDE, including the following:

    a) The daily NOx emissions.

    b) The date of any deviation from a permit term or condition that occurred during the reporting period and the corrective actions taken to resolve the deviation.

c) The date of return to compliance for any deviation that had occurred during the reporting period.

d) A Corrective Action Plan, including the anticipated remedy, for all outstanding deviations at the time of reporting.

e) Any additional information for determining the compliance status with the permit required by the MDE in writing prior to the start of the reporting period.

8. US Wind will promptly report to the MDE all instances of deviations from permit requirements, within three days of discovery of such deviation.

Annual Compliance Certification

9. The Responsible Official will certify, annually for the calendar year, that the facility is in compliance with the requirements of the OCS air permit. The report will be postmarked or delivered by January 31st each year to the MDE. The report will be submitted in compliance with the submission requirements below and will include:

   a. the terms and conditions of the permit that are the basis of the certification;

   b. the current compliance status and whether compliance was continuous or intermittent during the reporting period;

   c. the methods used for determining compliance, including a description of the monitoring, record keeping, and reporting requirements and test methods; and

   d. any additional information required by the MDE to determine the compliance status of the source.