APPLICATION

- **April 26, 2018 Application**
- **Application Additional Information**

April 26, 2018 Application

Ørsted

Ms. Suilin Chan
Chief, Permitting Section
U.S. EPA, Region 2
290 Broadway, 25th Floor
New York, NY 10007-1866

Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf, OCS-A 0498 – 40 CFR Part 55 OCS Air Permit Application

26 April 2018

Our Ref: 00121279

Ocean Wind LLC
One International Place
Suite 2610
Boston
MA 02114

Dear Ms. Chan:

Ocean Wind LLC is pleased to submit the enclosed Outer Continental Shelf (OCS) air permit application to the United States Environmental Protection Agency (U.S. EPA). The application includes the air emission sources and potential emissions associated with Ocean Wind LLC's proposed deployment of two floating Light Detection and Ranging (FLiDAR) buoys within a portion of the area under the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0498).

A Notice of Intent (NOI) for this application, which was developed to meet the requirements in 40 CFR §55.4(a) and §55.4(b)(1)-(10), was submitted to U.S. EPA on December 21, 2017, and revised on February 21, 2018.

Please contact Marcus Cross at marcr@orsted.com or +1 857 310-8232 if you have any questions or require additional information. Thank you in advance for your time and assistance.

Sincerely,

Marcus Cross
Senior Project Lead, Ocean Wind LLC.

cc: Viorica Petriman, U.S. EPA Region 2
Sara Froikin, U.S. EPA Region 2
Francis Steitz, NJDEP
Charles R. Scott, Ocean Wind LLC

OUTER CONTINENTAL SHELF
AIR PERMIT APPLICATION

Ocean Wind, LLC Energy Project
FLiDAR Buoy Deployment

Prepared for:

Ørsted
Formerly DONG Energy

One International Place, Suite 2610
Boston, MA 02110

Prepared by:

TETRA TECH

Tetra Tech, Inc.
160 Federal Street, 3rd Floor
Boston, MA 02110

www.tetratech.com

April 2018

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
Btu	British thermal unit
BOEM	Bureau of Ocean Energy Management
CARB	California Air Resources Board
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
COA	Corresponding Onshore Area
ECA	Emission Control Area
EPA	U.S. Environmental Protection Agency
FIR	Fisheries Industry Representatives
FLiDAR	floating light detection and ranging
FLO	Fisheries Liaison Officer
ft.	foot
GHG	greenhouse gases
g/kWh	grams per kilowatt-hour
GWP	Global Warming Potential
ha	hectare
HAPs	Hazardous Air Pollutants
hp	horsepower
IMO	International Maritime Organization
kg	kilogram
kW	kilowatt
L	liter
lb/hr	pounds per hour
m	meter
MARPOL	International Convention on the Prevention of Pollution from Ships
MMBtu/hr	million Btu per hour
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NESHAP	National Emission Standards for Hazardous Air Pollutants
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
nm	nautical mile
NOA	Nearest Onshore Area
NOI	Notice of Intent
NO_X	nitrogen oxides

Acronym	Definition
N_2O	nitrous oxide
NNSR	Nonattainment New Source Review
NSPS	New Source Performance Standards
NSR	New Source Review
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
O_3	ozone
PM	particulate matter
$PM_{2.5}$	particulate matter smaller than 2.5 micrometers in diameter
PM_{10}	particulate matter smaller than 10 micrometers in diameter
Project	Ocean Wind FLiDAR Buoy Deployment Project
PSD	Prevention of Significant Deterioration
SAP	Site Assessment Plan
SO_2	sulfur dioxide
tpy	tons per year
ULSD	ultra-low sulfur diesel
U.S.C.	United States Code
USCG	United States Coast Guard
VOC	volatile organic compounds
WEA	New Jersey Wind Energy Area

1 INTRODUCTION

Ocean Wind, LLC is proposing to install and operate two floating light detection and ranging (FLiDAR) buoys ("the Project") off the coast of New Jersey. This Outer Continental Shelf (OCS) air permit application for the proposed Project is being submitted in accordance with the United States Environmental Protection Agency's (EPA) OCS air regulations under 40 CFR Part 55, and has been prepared in accordance with applicable New Jersey Department of Environmental Protection (NJDEP) regulations under N.J.A.C. 7:27-8 for minor source permitting of stationary sources. Included with this OCS air permit application are detailed emission calculations in Appendix A, vendor equipment specifications in Appendix B, supplemental tables of equipment and emissions in Appendix C, and two letters from the operator of the proposed work boat in Appendix D.

The OCS air regulations under 40 CFR 55 specify that OCS sources located within 25 miles[1] of a State's seaward boundary are subject to the Federal requirements under 40 CFR 55.13, and the Federal, State, and local requirements of the Corresponding Onshore Area (COA) under 40 CFR 55.14. A Notice of Intent (NOI), required under 40 CFR 55.4, was submitted to EPA on December 21, 2017, and was revised on February 21, 2018, satisfying the requirements under 40 CFR 55.4(a). As specified under 40 CFR 55.6(b), operators of OCS sources located within 25 miles of a State's seaward boundary are required to submit an application and obtain a permit satisfying the requirements in 40 CFR 55.13 and 55.14 prior to commencing with construction activities.

As further specified under §55.6, an OCS air permit application shall not be submitted "until the Administrator has determined whether a consistency update is necessary, pursuant to §55.12 of this part, and, if the Administrator finds an update to be necessary, has published a proposed consistency update." On February 13, 2018, EPA published a consistency update to the OCS air regulations in the Federal Register,[2] for OCS sources for which the State of New Jersey is the COA. The consistency update requirement under §55.12 has therefore been satisfied.

Each of the two FLiDAR buoys will be equipped with a small backup diesel generator engine, and will therefore be considered OCS sources. One FLiDAR buoy will be located approximately 12 nautical miles southeast of Strathmere, New Jersey, and the second FLiDAR buoy will be located approximately 18 nautical miles south of Atlantic City.

Under the plain language of 40 CFR 55.2, the marine vessels proposed to be used for installation, maintenance, and decommissioning of the FLiDAR buoys will not, in and of themselves, qualify as OCS sources, because they will not be "[p]ermanently 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]."

Rather, the vessels would only qualify as OCS sources under the language of 40 CFR 55.2 to the extent they are "[p]hysically attached to an OCS facility, in which case only the stationary source aspects of the

[1] The regulation does not specify whether these miles are statute miles or nautical miles; they have conservatively been interpreted as nautical miles for the purpose of this OCS air permit application.
[2] See 83 FR 6136, available at: https://www.regulations.gov/document?D=EPA-R02-OAR-2017-0723-0002.

vessels will be regulated."[3] In fact, however, the vessels will not have any "stationary source aspects" during the brief periods they may be physically attached to an "OCS facility."[4]

Therefore, in accordance with the definition of "potential emissions" in §55.2, only the marine vessel emissions when operating within 25 nautical miles of the two FLiDAR buoys have been included in the potential emissions for the OCS sources in this OCS air permit application.

The proposed Project is discussed in the following sections. Because the Project will meet the definition of an "exploratory OCS source" under §55.2, and will be located within 25 nautical miles of a state's seaward boundary, the Nearest Onshore Area (NOA) will automatically be designated as the COA in accordance with §55.5(a). Therefore, the state of New Jersey will be the COA for the Project. EPA has not delegated authority to NJDEP to implement the OCS air regulations under 40 CFR 55, and therefore EPA remains the permitting authority for OCS sources where New Jersey has been designated as the COA.

General information about the Project applicant has been summarized in Table 1.

Table 1. Project Applicant Summary

Project / Facility Name:	Ocean Wind
Project / Facility Location:	12.3 nautical miles southeast of Strathmere, NJ, and 17.8 nautical miles south of Atlantic City, NJ, Official Protraction Diagram Wilmington NJ18-02, Blocks 7081 and 6986 FLiDAR 1: 39.070791 °N, 74.44385 °W FLiDAR 2: 39.134194 °N, 74.167778 °W
Applicant Name / Owner:	Ocean Wind, LLC
Address:	One International Place, 100 Oliver Street, Suite 2610, Boston, MA 02110
Project / Facility Contact:	Marcus Cross
Phone:	(857) 310-8232
Email:	marcr@orsted.com

2 PROJECT DESCRIPTION

The Project will consist of the deployment, operation, and decommissioning of two floating light detection and ranging buoys (FLiDARs). Ocean Wind, LLC has selected the AXYS Technologies Inc. (AXYS) WindSentinel™ FLiDAR Buoy as the proposed meteorological data collection technology. The two Project buoys will be located within a Lease Area[5] issued to Ocean Wind, LLC by the Bureau of Ocean Energy Management (BOEM) under Lease No. OCS-A 0498, at OCS Blocks 7081 and 6986. FLiDAR 1 will generally be located at coordinates 39.070791°N, 74.44385°W, and FLiDAR 2 will generally be located at coordinates 39.134194°N, 74.167778°W. The Source Industry Classification (SIC) Code for the Project is

[3] "OCS facility" is not defined in OCSLA or in EPA's regulations, but is elsewhere defined by mimicking OCSLA Section 4(a)(1)'s reference to exploration, development, and production of resources: "any artificial island, installation, or other device permanently or temporarily attached to the subsoil or seabed of the Outer Continental Shelf, erected for the purpose of exploring for, developing, or producing resources therefrom . . . ." 33 C.F.R. § 140.10 (2017).

[4] "OCS facility" is not defined in OCSLA or in EPA's regulations. But, given the absence of "stationary source aspects" in this application, it appears unnecessary to consider whether "OCS facility" should—like 40 CFR 55.2's first test for whether a vessel is an OCS source—be interpreted by reference to OCSLA Section 4(a)(1). *Cf.* 33 C.F.R. § 140.10 (2017) (adopting definition of "OCS facility" that mirrors OCSLA Section 4(a)(1)).

[5] The Lease Area is defined by *Addendum A of BOEM Lease No. OCS-A 0498, Section II. Description of the Lease Area*. The total acreage of the Lease Area is approximately 160,480 acres. The Lease Area is depicted in its entirety on Figure 1.

8731, “Commercial Physical and Biological Research,” and the 2012 North American Industry Classification System (NAICS) code is 541715, “Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology).”

The purpose of the Project is to collect wind resource data to support development of the Lease Area. Additional details about the FLiDAR buoys and their mooring systems are provided below.

2.1 WindSentinel FLiDAR Buoys

Each WindSentinel™ FLiDAR buoy will consist of instrumentation and supporting systems atop a floating moored buoy platform (see Figure 2). The floating platform consists of the AXYS Navy Oceanographic Meteorological Automated Device hull, mooring chain, clump weight anchor and pendant marker buoy. The hull consists of marine-grade 5086 aluminum and measures 20.7 feet (ft.) (6.3 meters [m]) long by 10.5 ft. (3.2 m) wide and weighs 15,000 pounds (lbs) (6,818 kilograms [kg]) (bare hull weight). The vertical profile of the WindSentinel™, including instrumentation, will be approximately 13.5 ft. (4.1 m) from the sea surface to the top of the hull mast. The submerged portion of the hull would measure approximately 8.5 ft. (2.6 m) below the sea surface from the water line to the bottom of the mooring yoke. The outer hull is constructed of a corrosion resistant marine grade stainless steel. The hull has also been designed with consideration for avian species. Landing areas have been minimized and anti-perching devices will be installed on the lights and mast.

The instrumentation on each FLiDAR buoy will be powered by an array of 40x100-amp hour lead acid batteries, primarily charged by a hybrid wind-solar system. Each FLiDAR buoy will be equipped with a 13.4 horsepower (10 kilowatt)[6] diesel generator engine as a secondary backup battery charging source. Each FLiDAR buoy will record status information, including the total hours of run time on each generator engine. This information will be transmitted in regular status messages from the buoy to shore via 2-way satellite communication channels. In the event that both the primary charging system and the backup diesel generator are not functioning, a 2 x 240 watt solar panel array will be mounted on the FLiDAR superstructure, and will provide enough power to signal the Project operators that the main and backup power systems are down.

2.2 Mooring Design

The WindSentinel™ FLiDAR buoys will be attached to the seafloor by means of a u-mooring design which is comprised of a chain that connects the WindSentinel™ to both a primary and secondary clump anchor on the sea floor as well as a pendant buoy on the surface of the water (see Figure 3). The u-mooring design facilitates recovery of the WindSentinel™ in higher sea state conditions by allowing the mooring to be recovered and the WindSentinel™ to be towed without the need to transfer personnel at sea. The primary and secondary clump weights would weigh approximately 5.5 tons (5,000 kg) and 3.3 tons (3,000 kg), respectively and sit on the seabed for a total area of up to 42 ft.^{2} (3.9 m^2). The chain would be attached to the base of the hull via the steel mooring yoke. The area of the anchor chain sweep associated with the long-term operation of the WindSentinels™ are anticipated to be approximately 3.1 acres (1.3 ha) (based on anchor chain radii of approximately 195.2 ft. [59.5 m], 72.2 ft. [22 m].and 442.9 ft. [135 m] of connector

[6] Each FLiDAR buoy engine will be physically derated to operate at only 3.5 kW; potential emissions have been based on this derated power output.

chain on the seafloor) for F1, and 2.6 acres (1.1 hectares [ha]) (based on anchor chain radii of approximately 173.9 ft. [53 m], 72.2 ft. [22 m], and 442.9 ft. [135 m] connector chain on the sea floor) for F2 . Vertical penetration of the primary and secondary clump weights into the seabed is anticipated to be approximately 6.6 ft. to 9.9 ft. (2 m to 3 m) and 3.3 to 6.6 ft. (1m to 2 m), respectively.

3 EMISSION SOURCES AND DESCRIPTION OF ACTIVITIES

The emission sources associated with the Project will consist of two backup diesel generator engines and associated fuel tanks, one to be located on each of the two FLiDAR buoys, and the marine vessels to be used for deployment, operational maintenance, and decommissioning of the two Project buoys. Vendor specification sheets for the FLiDAR generator engines, as well as information pages for the representative vessels used as the basis for potential emissions for the Project, are included in Appendix B.

As noted in section 1, only the backup diesel generator engines installed on the FLiDAR buoys are considered to meet the definition of "OCS source" under 40 CFR 55. However, the definition of "potential emissions" for an OCS source under §55.2 states that "emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source, and while enroute to or from the source when within 25 miles[7] of the source, and shall be included in the 'potential to emit' for an OCS source."

Therefore, the potential emissions presented in this OCS air permit application include emissions from the backup diesel generators to be located on the FLiDAR buoys, as well as from the marine vessels to be used for deployment, operational maintenance, and decommissioning of the Project. Emissions sources are described in more detail in the following sections.

3.1 Summary of Activities

The sequence of activities associated with the installation, operation, and decommissioning of the Project buoys is summarized below, and described in detail in section 3.5.

1. It is projected that one workboat and a smaller support vessel will be used for installation of the two Project buoys.
2. Each buoy will either be loaded onto the deck of the workboat, or towed to the installation area.
3. On arrival at each FLiDAR deployment location, the mooring system will be safely deployed with a temporary buoy attached. The temporary buoy will then be picked up by boat hook and brought on deck of the work vessel and attached to the FLiDAR buoy for deployment.
4. Deployment of the buoys will take place at the beginning of year 1 of the Project.
5. Maintenance visits to the buoys will be conservatively planned to occur every 3 months during the operational period of the Project, which will last 2 years.
6. A one-time annual inspection operation will be conducted one year after installation of the Project buoys.

[7] The regulation does not specify whether these miles are statute miles or nautical miles; they have conservatively been interpreted as nautical miles for the purpose of this OCS air permit application.

7. The two FLiDAR buoys are scheduled to be decommissioned at the end of their 2-year operational life. Decommissioning will be a reverse of the deployment activities.

3.2 Deployment Air Emission Sources

Emissions associated with deployment of the Project buoys will result from the use of marine vessels during the transport and deployment activities. Although the exact vessels selected to support the Project may be subject to change, it is anticipated that the following vessels will be used:

- **Workboat**: One workboat vessel will be used to transport each Project buoy to its deployment location, either carried on deck or towed behind. Potential emissions for the workboat are based on the specifications for the Northstar Commander, a 92 ft. (28m) multipurpose utility vessel, equipped with:
  - two twin-screw Volvo D12D-G MH main engines, model year 2008, rated at 450 hp each;
  - one John Deere 4045TF auxiliary generator engine, model year 2015, rated at 65 kW;
  - one Caterpillar auxiliary generator engine, model unknown, reconditioned in 2010, rated at 65 kW (only one auxiliary generator will operate at any given time, with the second generator serving as a backup); and
  - one Detroit 4-53 Series 53 diesel engine, model year unknown, rated at 120 hp, to supply hydraulic power to the 75-ton tow winch, 3.75 ton knuckleboom crane, and A-frame (indicated by the vessel operator to be certified for land-based use).

  The workboat main engine stacks are approximately 25 ft. above the water surface.

- **Support Vessel**: One smaller support vessel will accompany the workboat during the deployment activity. Potential emissions for the support vessel are based on the specifications for the Northstar Enterprise, a 41 ft. (12.5m) boat equipped with two Volvo D9 main engines, model year 2013 or earlier, rated at 425 hp each. There is no auxiliary generator engine on the Northstar Enterprise. The Northstar Enterprise is not equipped with engine stacks, and the exhaust points are at water level.

3.3 Operational Air Emission Sources

Emissions associated with the operational phase of the Project will result from operation of the backup diesel generator engines installed on each FLiDAR buoy, and from use of a support vessel for scheduled maintenance on the Project buoys. The following emission sources are anticipated to be used during operation of the Project:

- **FLiDAR Backup Diesel Generator Engines:** Each of the two FLiDAR buoys will be equipped with a single Yanmar 2TNV70 naturally-aspirated 4-stroke, 2-cylinder diesel engine, model year 2011, rated at 13.4 horsepower (10 kW)[8], with an approximate maximum heat input rate of 134,000 British thermal units (Btu) per hour. The manufacturer has certified this model to be compliant with the 40 CFR 60 Subpart IIII standards for post-2007 emergency engines rated between 11 and 25 horsepower (8 and 19 kW). Each engine will be equipped with a 900-liter (238 gallon) fuel oil

[8] Each FLiDAR buoy engine will be physically derated to operate at only 3.5 kW; potential emissions have been based on this derated power output.

storage tank. The engine exhaust pipes will be routed to exit just below the water surface. The generator engines will not run during normal operating conditions, but will only be used to provide backup power for charging the lead acid battery array on each FLiDAR buoy when the primary charging method, a hybrid wind-solar system, is unable to provide sufficient power. Potential emissions for the FLiDAR buoy generator engines are based on no more than 500 operating hours per year, per buoy. Each FLiDAR buoy will record status information, including the total hours of run time on each generator engine. This information will be transmitted in regular status messages from the buoy to shore via 2-way satellite communication channels.

- **Workboat**: One workboat will be used to perform an annual inspection operation on each FLiDAR buoy, halfway through the 2-year operational life of the Project. The trips will once again originate and terminate at the Avalon Marine Center. Potential emissions for the workboat are again based on the specifications for the Northstar Commander.
- **Support Vessel**: A single support vessel will be used to perform scheduled maintenance on the buoys at 3-month intervals during the operational life of the Project, and will accompany the workboat during the annual inspection operation. Potential emissions for the support vessel are again based on use of the Northstar Enterprise, with trips originating and terminating at the Avalon Marine Center.

3.4 Decommissioning Air Emission Sources

Emissions associated with decommissioning of the Project buoys will result from the use of marine vessels during retrieval and transporting the buoys back to shore. The following emission sources are anticipated to be used during decommissioning:

- **Workboat**: One workboat will be used to retrieve each Project buoy and return it to shore at the end of its 2-year operational life. One separate decommissioning trip will be scheduled for each FLiDAR buoy. The trips will once again originate and terminate at the Avalon Marine Center. Potential emissions for the workboat are again based on the specifications for the Northstar Commander.
- **Support Vessel**: One support vessel will accompany the workboat during each decommissioning trip. Potential emissions for the support vessel are again based on use of the Northstar Enterprise, with trips originating and terminating at the Avalon Marine Center.

3.5 Detailed Procedures for Installation, Maintenance, and Decommissioning

The following subsections provide detailed, step-by-step descriptions of the equipment and procedures that are anticipated to be used during the installation, maintenance, and decommissioning of the Project buoys. The estimated durations for each activity described below assume good weather conditions. To ensure that these durations reflect a reasonable worst-case scenario, Ocean Wind, LLC will make best endeavors to target only suitable weather windows for installation, maintenance, and decommissioning activities.

3.5.1 Controlled Lowering Deployment Procedure

These procedures will be used for initial installation of each Project buoy at its deployment location, and for redeployment of each Project buoy following the one-time annual inspection operation. Each deployment will require the use of one workboat and one support vessel. The deployment of the Project buoys is anticipated to require a separate round trip for each buoy, originating and concluding at the Avalon Marine Center in Avalon, NJ, which is located approximately 12 nautical miles from the FLiDAR 1 deployment location.

The single round-trip distances to each of the deployment locations and then back to the Avalon Marine Center are estimated to be 28 nautical miles for FLiDAR 1 (about 3 hours total transit time), and 45 nautical miles for FLiDAR 2 (about 4.5 hours total transit time). The main engines of both vessels, as well as one auxiliary generator engine on the workboat, will operate for the entire duration of each trip, which includes the transit time plus an estimated 12 hours of work at each deployment location per trip. The hydraulic power engine on the workboat will only operate while in the immediate vicinity of each deployment location. The workboat and support vessel will hold station manually using their main engines during deployment operations, and will therefore not be “attached to the seabed and erected thereon” per 40 CFR 55.2’s first test for whether a vessel is an OCS source. And during the brief periods in which the vessels may be “physically attached” to a deployed FLiDAR buoy, they will not have any “stationary sources aspects” per the regulation’s second test.

1. One deployment vessel (Northstar Commander or similar) will tow each FLiDAR buoy out one at a time, using the support vessel to keep the buoy away from the deployment vessel during installation activity.
2. On arrival at the designated deployment location, the vessel master and party chief will verify the deployment position using onboard navigation position system. Sea state conditions will be assessed to establish the movement of the buoy and response to the combined wind, wave and tidal current interaction.
3. A plan will be formulated between the vessel master and party chief for the safest orientation of the deployment vessel with regard to wind, wave and tidal current.
4. A pre deployment Tool Box Talk (TBT) will be held to step through the deployment procedure and ensure all roles, responsibilities, communications and methods are fully understood by all team members.
5. The support vessel crew will pick up the 5m x 25mm diameter line trailing from the port stern fairlead of the buoy and secure to the vessel with a longer steady line. Light pressure (<100kg) will be applied by the support vessel to keep the buoy away from the stern of the vessel during mooring deployment. After deployment of the mooring, this line can be removed from the aft cleat of the buoy with a boat hook.
6. The deployment vessel will winch in the tow line until approximately 10m of the chain connected to the buoy mooring yoke is on deck and secured with a chain stopper (e.g. pelican hook).
7. The end of the chain connected to the buoy mooring yoke will be connected to the bitter end of the chain connected to the 5,000 kg anchor and inspected.
8. Once the connection is secure, the deck winch will connect to the first bight of chain (the first loop at the forward part of the work deck) and the rotten stop will be removed.
9. The deck winch will take the load off the chain stopper at the stern by taking up on the cable
10. The chain stopper will be removed, and the deck winch will begin to lower the first deck-length of chain off the stern of the vessel

11. In parallel, the support vessel will lightly tow the buoy away from the stern of the deployment vessel.
12. Once the deck winch cable reaches the stern, a chain stopper will be secured to the chain above the deck winch cable connection point (closer to the deck winch drum than the connection point).
13. Once the chain stopper is secured, the deck winch cable will continue to let out cable so that the load is transferred to the chain stopper.
14. The deck winch cable will be removed and recoiled on the drum, and connected to the next bight of chain (the second loop at the forward part of the work deck) and the rotten stop will be removed.
15. The deck winch will take the load off the chain stopper at the stern by taking up on the cable.
16. The chain stopper will be removed, and the deck winch will begin to lower the second deck-length of chain off the stern of the deployment vessel.
17. Once the deck winch cable reaches the stern, a chain stopper will be secured to the chain above the deck winch cable connection point.
18. Once the chain stopper is secured, the deck winch cable will continue to let out cable so that the load is transferred to the chain stopper.
19. The deck winch cable will be removed and recoiled on the drum, and connected to the next bight of chain.
20. This process will be repeated until the 5,000 kg anchor is reached.
21. At this point, the A-frame cable will be connected to the 5,000 kg anchor, which is still secured to the deck.
22. The deck winch cable will be removed and connected to the first bight of chain down-line from the 5,000 kg anchor (in between the 5,000 kg anchor and the 2,500 kg anchor) and the rotten stop will be removed.
23. The A-frame will pick the 5,000 kg anchor (via a Quick Release) off the deck and move it out over the water away from the stern.
24. In parallel, the deck winch will begin to lower the first bight of chain down-line of the 5,000 kg anchor so that the 5,000 kg anchor is able to be lowered into the water.
25. Once the 5,000 kg anchor is lowered approximately 5m below the water surface, it is planned that when the anchor is at the prescribed depth, the quick release will be at deck level. The chain on deck to the anchor will then be tensioned by the deck winch line to take the weight of the anchor prior to release of the quick release. The Quick Release and A-frame are then disconnected from the anchor.
26. The deck winch will continue to lower the chain off the stern of the vessel
27. Once the deck winch cable reaches the stern, a chain stopper will be secured to the chain above the deck winch cable connection point.
28. Once the chain stopper is secured, the deck winch cable will continue to let out cable so that the load is transferred to the chain stopper.
29. The deck winch cable will be removed and recoiled on the drum, and connected to the next bight of chain and the rotten stop will be removed.
30. The deck winch will take the load off the chain stopper at the stern by taking up on the cable.
31. The chain stopper will be removed, and the deck winch will begin to lower the next deck-length of chain off the stern of the vessel.

32. This process will be repeated until the water depth mark on the chain is about 10m from the stern, indicating that the anchor is roughly 10m from the bottom (as estimated from vessel sounder, charts and tide tables).
33. The deployment vessel will adjust its position so that the stern is directly above the 5,000 kg target coordinates.
34. Once the stern is confirmed on the target coordinates, the chain will continue to be lowered and the anchor will be placed on the seafloor.
35. The vessel will then change its heading so that its course is towards the location of the 2,500 kg anchor, and will continue to let out chain in the same bight-by-bight fashion previously described.
36. The bight-by-bight process will be repeated until the 2,500 kg anchor is reached, at which point the same process described above for connecting to (via Quick Release) and lifting (with A-frame) will be utilized.
37. The deck winch will continue to lower the chain and 2,500 kg anchor until the water depth mark on the chain is about 10m from the stern, indicating that the anchor is roughly 10m from the bottom.
38. The same procedure for lowering the 5,000 kg anchor on the target coordinates will be utilized for placing the 2,500 kg anchor on its target coordinates.
39. The deck winch will continue lowering the chain in the same bight-by-bight fashion until the pennant buoy is near the stern.
40. A chain stopper will be secured to the chain at the stern above the deck winch cable connection point.
41. Once the chain stopper is secured, the deck winch cable will continue to let out cable so that the load is transferred to the chain stopper.
42. The deck winch cable will be removed.
43. The A-frame cable will be connected to the pennant buoy lifting eye (via Quick Release)
44. The A-frame cable will take up on the pennant buoy to transfer the load from the chain stopper, and the chain stopper will be removed.
45. The pennant buoy will be lowered into the water by the A-frame and released via the Quick Release, completing the deployment.
46. Using support boat to keep buoy a safe distance away from the vessel, winch tow rope in until there is a suitable working length of chain on deck (3-5 meters) for connecting to the rest of the mooring.
47. Secure the buoy chain with a pelican slip, leaving a suitable working length for connecting the buoy chain to the rest of the mooring chain.
48. Connect mooring chain to the ballast sinker weight and to the buoy.
49. Move ballast sinker weight over the aft roller in preparation for lowering. Secure with a safety line or a strop.

3.5.2 Mooring and Buoy Recovery Procedure

These procedures will be used for retrieval of each Project buoy prior to the one-time annual inspection operation, and for decommissioning of each Project buoy at the end of its 2-year operational life. Each mooring and buoy recovery will require the use of one workboat and one support vessel, and is anticipated to require a separate round trip for each buoy, originating and concluding at the Avalon Marine Center in Avalon, NJ, which is located approximately 12 nautical miles from the FLiDAR 1 deployment location.

The single round-trip distances to each of the deployment locations and then back to the Avalon Marine Center are estimated to be 28 nautical miles for FLiDAR 1 (about 3 hours total transit time), and 45 nautical miles for FLiDAR 2 (about 4.5 hours total transit time). The main engines of both vessels, as well as one auxiliary generator engine on the workboat, will operate for the entire duration of each trip, which includes the transit time plus an estimated 12 hours of work at each deployment location per trip. The hydraulic power engine on the workboat will only operate while in the immediate vicinity of each deployment location. The workboat and support vessel will hold station manually using their main engines during deployment operations, and will therefore not be "attached to the seabed and erected thereon" per 40 CFR 55.2's first test for whether a vessel is an OCS source. And during the brief periods in which the vessels may be "physically attached" to a deployed FLiDAR buoy, they will not have any "stationary source aspects" per the regulation's second test.

1. Mooring recovery will commence with the connection and lift of the U mooring surface pendant buoy to deck using the vessel crane.
2. The mooring will be stopped off on deck and the pendant buoy disconnected from the mooring, moved away from the work area using the vessel crane as needed and secured.
3. The mooring will then be connected to the main deck winch.
4. The stopper will be removed and the mooring wound onto the main deck winch until the 2,500 kg anchor reaches the surface.
5. The 2,500 kg anchor will be connected to the aft deck crane and lifted to deck.
6. The mooring will be stopped off and the 2,500 kg anchor will be disconnected, moved away from the work area and secured.
7. The stopper will removed and the mooring wound onto the main deck winch until the 5,000 kg anchor reaches the surface.
8. The 5,000 kg anchor will be connected to the aft deck A-frame and lifted to deck.
9. The mooring will be stopped off and the 5,000 kg anchor will be disconnected, moved away from the work area and secured.
10. The stopper will removed and the main mooring wound onto the deck in bights with the main deck winch through to the swivel at 13.5m from the connection to the buoy.
11. The free end of the 13.5m section of mooring chain under the 6m buoy will be connected via a heavy duty polypropylene rope to the tow winch or tow anchor point.
12. Materials will be secured for the transit to the port.
13. A watch will be maintained onboard the vessel to monitor the tow.
14. Throughout the duration of the tow operation, the Master will make every effort to maintain a speed which does not exceed the tow rate recommendations indicated in the Safe Working Limits described in the full Risk Assessment and Method Statement document prepared for the specific operation.

3.5.3 Inspection, Maintenance, and Change-Out Activities

Annual Inspection Operation

An annual inspection operation for the mooring systems will be scheduled to occur one year after deployment of the FLiDAR buoys. The operational life of the FLiDAR buoys will only be 2 years, so no annual inspection operation will be conducted at the end of the second year; rather, the two FLiDAR buoys and their mooring systems will simply be decommissioned (i.e. recovered). The annual inspection operation will require the use of one workboat and one support vessel, and is anticipated to require two separate round trips for each buoy (one round trip to recover each buoy and mooring, and a second round trip for redeployment), originating and concluding at the Avalon Marine Center in Avalon, NJ, which is located approximately 12 nautical miles from the FLiDAR 1 deployment location.

The single round-trip distances to each of the deployment locations and then back to the Avalon Marine Center are estimated to be 28 nautical miles for FLiDAR 1(about 3 hours total transit time), and 45 nautical miles for FLiDAR 2 (about 4.5 hours total transit time). The main engines of both vessels, as well as one auxiliary generator engine on the workboat, will operate for the entire duration of each trip, which includes the transit time plus an estimated 12 hours of work at each deployment location per trip. The hydraulic power engine on the workboat will only operate while in the immediate vicinity of each deployment location.

During the annual inspection operation, the entire mooring system for each buoy will be recovered, and each FLiDAR buoy will be towed to shore for maintenance. Following completion of the annual inspection and maintenance, each FLiDAR buoy and mooring system will be redeployed at the original location. The detailed steps for recovery and redeployment of each buoy and mooring system are identical to those that will be followed during installation and decommissioning activities for the two FLiDAR buoys. The annual inspection operation will require two round trips per FLiDAR deployment location for both the workboat vessel and the support vessel (one round trip to retrieve and one round trip to redeploy).

Inspection of the mooring system will be completed on the workboat deck as the FLiDAR buoy is being towed back to port. Any items requiring service or replacement will be flagged to be addressed prior to the redeployment operation.

The following additional annual maintenance tasks will be performed while at port:

- Removal of biofouling from the buoy using a pressure washer, as well as hand tools such as scrapers. The pressure washer will be located on the dock and will be powered by an internal combustion engine, but as this engine will be located onshore and will not be onboard a vessel, it will not meet the definition of an OCS source under 40 CFR 55.2.
- Refilling of the 238-gallon diesel fuel tank located on each FLiDAR buoy will be performed while at port. This fuel storage capacity is sufficient to allow operation of each FLiDAR generator engine for more than one year, given their proposed limitation of 500 operating hours per year.

Quarterly Maintenance Visits

In addition to the annual inspection, quarterly maintenance visits to the two FLiDAR buoys will be scheduled to occur every 3 months during the operational life of the project, which will last 2 years. Each quarterly maintenance visit will require the use of one support vessel, and is anticipated to require only a single round trip to visit both Project buoys, originating and concluding at the Avalon Marine Center in Avalon, NJ, which is located approximately 12 nautical miles from the FLiDAR 1 deployment location.

The round-trip distance to visit both Project buoy deployment locations and then return to the Avalon Marine Center is estimated to be 49.5 nautical miles (about 5 hours total transit time). The estimated vessel emissions assume that the main engines of the support vessel will operate for the entire duration of each trip, which includes the transit time plus an estimated 5 hours of work at each deployment location per trip. (However, the support vessel is capable of shutting off its main engines and operating on only battery power when tethered to the buoy.) The support vessel will pull alongside each buoy and either tether the buoy to the vessel, or maintain station to allow transfer of personnel and tools to the buoy for the operation.

Planned quarterly maintenance activities for the two FLiDAR buoys will be limited to above-surface buoy components, and will include replacement of consumables, service of sensors, data retrieval, and cleaning of solar panels and wind turbines. Refilling of the 238-gallon diesel fuel tank located on each buoy will not be done at sea, but will only be done in port during the annual inspection operation (see above).

4 POTENTIAL EMISSIONS

As previously noted, the definition of "potential emissions" for an OCS source under 40 CFR 55.2 states that "emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source, and while enroute to or from the source when within 25 miles[9] of the source, and shall be included in the 'potential to emit' for an OCS source." For the purpose of this OCS air permit application, we have conservatively assumed that all emissions from marine vessels servicing the Project will occur with 25 nautical miles of the Project buoy locations during deployment, operation, and decommissioning.

Sections 4.1 through 4.4 describe the applicable emission standards that apply to each of the emission sources associated with the Project, the actual emission factors that were used for calculating potential emissions, the how engine load factors were selected for each source.

Section 4.5 summarizes the Project's potential emissions in tons per year (tpy) for criteria air pollutants, which include nitrogen oxides (NOx), volatile organic compounds (VOC), carbon monoxide (CO), total particulate matter (PM), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), and sulfur dioxide (SO_2), as well as hazardous air pollutants (HAPs), and greenhouse gases (GHG), which include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). GHG emissions are presented in units of CO_2 equivalents, or CO_2e, based on the global warming potential (GWP) for each individual greenhouse gas relative to an equivalent mass of CO_2. Detailed emission calculations for all pollutants are presented in Appendix A. Supplemental tables that present equipment specifications, emission factors, and potential emissions for the Project in a format requested by EPA are also presented in Appendix C.

4.1 Determination of FLiDAR Engine Applicable Emission Standards

The Yanmar 2TNV70 diesel generator engines proposed to be installed on each FLiDAR buoy have been certified by the manufacturer to meet the emission standards for post-2007 emergency engines rated between 11 and 25 hp (8 and 19 kW), as specified in the New Source Performance Standards (NSPS) under 40 CFR 60 Subpart IIII. In its comments on the December 21, 2017 version of the NOI, EPA suggested

[9] The regulation does not specify whether these miles are statute miles or nautical miles; they have conservatively been interpreted as nautical miles for the purpose of this OCS air permit application.

that the FLiDAR generator engines should be considered non-emergency engines under Subpart IIII, because they may operate as backup power sources at times when power is still available from the FLiDAR buoy's primary wind-solar charging system, which EPA does not consider to qualify as an "emergency situation," because it is not an interruption of electric power.

EPA also suggested in its comments on the December 21, 2017 version of the NOI that, because the FLiDAR generator engines will be derated from their original output of 13.4 hp (10 kW) to a lowered output of 4.7 hp (3.5 kW), that these engines should instead be subject to the appropriate Subpart IIII standards that apply to engines rated at less than 11 hp (8 kW), rather than the original size category of 11 to 25 hp (8 to 19 kW).

In response to EPA's comments, the definitions in Subpart IIII under 40 CFR §60.4219 do not provide a clear definition of "emergency situation." Interruption of electric power is listed there as an "example" of an emergency situation, but this does not appear to exclude other possible circumstances that might qualify. Nonetheless, it is acknowledged that the proposed operation of the FLiDAR generator engines could be reasonably interpreted as non-emergency use.

Regarding the engine size category that should apply when an engine has been derated from its original manufacturer specifications, the definitions in Subpart IIII under 40 CFR §60.4219 state that "maximum engine power" means "maximum engine power as defined in 40 CFR 1039.801." In turn, 40 CFR 1039 indicates that "maximum engine power" should be based on the nominal power curve developed from "the manufacturer's design and production specifications for the engine." It is not clear that adding a mechanical limitation to prevent an engine from operating at its maximum output would qualify as a change to the "maximum engine power" as defined under 40 CFR 1039.

Nonetheless, the proposed Yanmar 2TNV70 diesel generator engines are certified to meet the Subpart IIII emission standards for post-2007 emergency engines rated between 8 and 19 kW, which are at least as stringent as the Subpart IIII standards that apply to post-2007 non-emergency engines less than 8 kW. As shown in Table 2 below, the Yanmar engines are capable of meeting any of the Subpart IIII emission standards that EPA suggests may apply. For the purpose of this OCS air permit application, potential emissions from the FLiDAR generator engines have been calculated using the manufacturer's certified emission rates.

Table 2. Comparison of Potentially Applicable FLiDAR Generator Engine Standards

Source of Value	Emission Standard or Manufacturer Certification (g/kWh)				
	NOx + HC	NOx	VOC	CO	PM
Subpart IIII, post-2007 emergency engines (8 <= kW < 19)	7.5	N/A	N/A	6.6	0.40
Subpart IIII, post-2007 emergency engines (kW < 8)	7.5	N/A	N/A	8.0	0.40
Subpart IIII, post-2007 non-emergency engines (8 <= kW < 19)	7.5	N/A	N/A	6.6	0.80
Subpart IIII, post-2007 non-emergency engines (kW < 8)	7.5	N/A	N/A	8.0	0.80
Actual manufacturer certified emission rates	6.0	N/A	N/A	1.3	0.15

4.2 Determination of Marine Engine Categories and Applicable Emission Standards

Emission standards for marine diesel engines are established under 40 CFR 94 and 40 CFR 1042.

Marine engines are classified as either Category 1, Category 2, or Category 3 engines based on their rated power and displacement per cylinder. 40 CFR 94 defines Category 1 as including any 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, while 40 CFR 1042 defines Category 1 as including any marine engine with a rated power greater than or equal to 37 kilowatts and a specific engine displacement less than 7.0 liters per cylinder.

Although specification sheets for the exact make and model of each proposed marine engine are not available, specifications for other marine engines of the same rated power indicate that all of the proposed vessel engines will have a likely displacement ranging between 1.0 and 2.0 L/cylinder, clearly classifying them as Category 1 engines.

Marine engines manufactured in 2004 or later will be subject to either 40 CFR 94 or 40 CFR 1042, depending on the exact year of manufacture. The applicability of 40 CFR 1042 has been gradually phased in, applying only to small engines with a low displacement per cylinder beginning with model year 2009, and adding new ranges of subject engine sizes in subsequent model years. Engines built prior to the year their size category under 40 CFR 1042 takes effect are instead subject only to 40 CFR 94.

The 450 hp Volvo D12D-G MH main engines on the Northstar Commander are model year 2008 engines, and while a specification sheet for this exact make and model was not available, specifications for the Volvo D12 MH family of marine diesel engines with the same horsepower rating were reviewed. Engines in the Volvo D12 MH family have 6 cylinders with a total displacement of 12.13 L, or 2.02 L per cylinder. Assuming the Volvo D12D-G MH has a similar displacement per cylinder, 40 CFR 1042 only applies to this size category for model years 2014 and later. Therefore, the Volvo D12D-G MH is subject to 40 CFR 94, which defines Category 1 as including any 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.

The two 65 kW generator engines on the Northstar Commander have a manufacture date of 2015 (John Deere 4045TF), and a reconditioning date of 2010 (Caterpillar, unknown model). While specification sheets for these exact engines were not available, similar marine generators of the same manufacturer and kW rating were reviewed, and indicate that John Deere engine has a likely displacement of approximately 1.25 L/cylinder, while the Caterpillar engine has a likely displacement of approximately 1.75 L/cylinder. Based on these power ratings and size categories, 40 CFR 1042 applies beginning with model years 2014 and later. Therefore, the John Deere generator engine is classified as a Category 1 engine under 40 CFR 1042, while the Caterpillar generator engine is a Category 1 engine under 40 CFR 94.

The proposed support vessel, the Northstar Enterprise, was repowered in 2013 with two Volvo D9 main engines, rated at 425 hp each, and is not equipped with any auxiliary engines. While specification sheets for these exact engines were not available, specifications for a Volvo D9-425 marine diesel engine with the same horsepower rating were reviewed. This engine has 6 cylinders with a total displacement of 9.4 L, or 1.6 L per cylinder. Assuming the engines on the Northstar Enterprise have a similar displacement per cylinder, 40 CFR 1042 applies beginning with model years 2014 and later. Therefore, it is believed that the Northstar Enterprise engines are classified as Category 1 engines under 40 CFR 94.

Table 3 summarizes the applicable Tier 2 emission standards for the anticipated Category 1 engines subject to 40 CFR 94, as well as the applicable Tier 3 emission standards applying to the anticipated Category 1 engines subject to 40 CFR 1042. For comparison, also shown are the emission factors used to calculate potential emissions for all engines, based on Table 3-8 in the April 2009 report from ICF International to U.S. EPA, "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories." As shown, the selected factors from the ICF International report are equal to or greater than the applicable Tier 2 and Tier 3 emission standards, and thus represent a conservative approach to estimating potential emissions.

Table 3. Applicable Marine Engine Emission Standards

Subject Engine or Guidance Document	Applicable Standard or Emission Factor (g/kWh)				
	NOx + HC	NOx	VOC	CO	PM
Volvo D12D-G MH 450 hp (2008 Category 1, Tier 2)	7.2	N/A	N/A	5.0	0.20
John Deere 4045TF 65 kW (2015 Category 1, Tier 3)	5.6	N/A	N/A	N/A	0.11
Caterpillar 65 kW (2010 Category 1, Tier 2)	7.2	N/A	N/A	5.0	0.20
Volvo D9 425 hp (2013 Category 1, Tier 2)	7.2	N/A	N/A	5.0	0.20
ICF International factor for harbor craft, Table 3-8	N/A	9.8	0.27	5.0	0.26

4.3 Determination of Workboat Hydraulic Engine Applicable Emission Standards

Based on correspondence with Northstar Marine, Inc., the Northstar Commander is equipped with a Detroit 4-53 Series 53 engine, rated at 120 hp, that provides hydraulic power to the 75-ton tow winch, 3.75 ton knuckleboom crane, and A-frame onboard the vessel. While the model year for this engine is unknown, Northstar Marine indicates that the Detroit engine is certified for land-based use, so it has been presumed to meet any applicable emission standards for stationary land-based engines under 40 CFR 60 Subpart IIII.

Since the model year for the Detroit engine is unknown, it has conservatively been assumed to be a pre-2007 model year engine. Potential emissions have been calculated using the Subpart IIII emission standards for pre-2007 non-emergency engines rated between 100 and 175 hp (75 and 130 kW), as shown in Table 4.

Table 4. Assumed Emission Standards for Workboat Hydraulic Engine

Source of Value	Emission Standard (g/kWh) /a				
	NOx + HC	NOx	VOC	CO	PM
Subpart IIII, pre-2007 non-emergency engines (75 <= kW < 130)	N/A	9.2	1.3	11.4	1.0
/a No standards for VOC, CO, or PM were provided in Subpart IIII for pre-2007 engines in this size category. Therefore, substitute values for VOC, CO, and PM were based on the worst-case rate provided for non-emergency pre-2007 engines in any size category.					

4.4 Selection of Engine Load Factors

In its comments on the December 21, 2017 version of the NOI, EPA expressed the position that potential emissions for an OCS source should be based on operation at its design capacity, which, absent an enforceable restriction, is 100% load. EPA also requested additional justification for the engine load factors of 43% and 45% used to calculate potential emissions from marine engines for the proposed Project, and asked whether Ocean Wind, LLC was contemplating a restriction that would limit marine engines to these load factors.

In response to EPA's comments, it is agreed that, absent an enforceable restriction, potential emissions from an OCS source should be based on operation at its design capacity, which is consistent with the definition of "potential emissions" under 40 CFR §55.2:

> Potential emissions means the maximum emissions of a pollutant from an OCS source operating at its design capacity. Any physical or operational limitation on the capacity of a source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as a limit on the design capacity of the source if the limitation is federally enforceable. Pursuant to section 328 of the Act, emissions from vessels servicing or associated with an OCS source shall be considered direct emissions from such a source while at the source, and while enroute to or from the source when within 25 miles of the source, and shall be included in the "potential to emit" for an OCS source. This definition does not alter or affect the use of this term for any other purposes under §§55.13 or 55.14 of this part, except that vessel emissions must be included in the "potential to emit" as used in §§55.13 and 55.14 of this part.

As noted previously in this OCS air permit application, only the backup diesel generator engines installed on the FLiDAR buoys are considered to meet the definition of "OCS source" under 40 CFR 55. Accordingly, potential emissions for the FLiDAR generator engines have been calculated based on operation at 100% of their (derated) output capacity, along with a restriction of 500 operating hours per year for each engine.

Speaking generally about potential emissions from marine vessels, Ocean Wind, LLC believes that the requirement to calculate potential emissions based on the "design capacity" of an engine or other emission source only applies to vessels if and when they meet the definition of "OCS source" under 40 CFR §55.2. This definition states that it "shall include vessels only 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. §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."

Based on this exclusion of vessels from the definition of "OCS source," except under the two conditions quoted above, Ocean Wind, LLC believes it is permissible to calculate the vessel portion of potential emissions for an OCS source based on operation at less than their design capacity. Additional justification for the engine load factors of 43% and 45% used to calculate potential emissions from marine engines is provided below. (However, potential emissions for the Detroit diesel engine on the workboat, which will provide hydraulic power for the winch, crane, and A-frame, have been calculated based on operation at 100% load, for the projected hours of operation as shown in Appendix A and Appendix C.)

The selected average load factors of 43% for the workboat main and auxiliary engines, and 45% for the support vessel main engines, are based on Table 3-4 in the April 2009 report prepared by ICF International for U.S. EPA, "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories."[10] The ICF report, in turn, based these load factors on the 2007 air emissions inventories prepared by Starcrest Consulting Group LLC, for the Port of Los Angeles[11] and the Port of Long Beach.[12] These load factors are based on a combination of: actual vessel engine load data for the Port of Los Angeles; the methodology used by the California Air Resources Board (CARB) for its commercial harbor craft emission inventories;[13] and EPA's NONROAD2005 model for estimating emissions from nonroad engines. The NONROAD2005 supporting documentation estimated a load factor of 43% for both inboard and outboard diesel engines.[14] (The latest EPA nonroad model, NONROAD2008a, has since reduced both of these marine engine load factors to 35%, although the older factor of 43% has been retained for calculation of marine vessel emissions for the proposed Project.[15])

Finally, as discussed in the ICF report, the Propeller Law can also be used to estimate a load factor for propulsion engines based on the actual vessel speed:

$$LF = (AS / MS)^3$$

Where:

LF = Load Factor (percent)
AS = Actual Speed (knots)
MS = Maximum Speed (knots)

A load factor of 43% (or 0.43) would correspond to a vessel travelling at 75% of its maximum speed. All vessels for the Project will operate at speeds of 10 knots or less, which means the actual load factor for their propulsion engines should be much less than 43% given that vessels of these types typically have maximum speeds approaching 20 knots (or higher).

In conclusion, Ocean Wind, LLC believes that the use of engine load factors of 43% and 45% for calculating potential emissions from marine engines for the proposed Project is supported and justified by the previous use of these load factors in methodologies sanctioned by a variety of government agencies for the estimation

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[10] ICF International. 2009. Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, prepared for the USEPA Office of Policy, Economics, and Innovation, Sector Strategies Program. Final Report. April 2009. Available at: https://www.epa.gov/sites/production/files/2016-06/documents/2009-port-inventory-guidance.pdf

[11] Starcrest Consulting Group, LLC. 2009. Port of Long Angeles Inventory of Air Emissions - 2007. December 2008. Available at: https://www.portoflosangeles.org/DOC/REPORT_Air_Emissions_Inventory_2007.pdf.

[12] Starcrest Consulting Group, LLC. 2009. Port of Long Beach Air Emissions Inventory - 2007. January 2009. Available at: http://www.polb.com/civica/filebank/blobdload.asp?BlobID=6029.

[13] California Air Resources Board (CARB). 2007. Technical Support Document: Initial Statement of Reasons for Proposed Rulemaking. Proposed Regulation for Commercial Harbor Craft, Appendix B: Emissions Estimation Methodology for Commercial Harbor Craft Operating in California. September 2007. Available at: https://www.arb.ca.gov/regact/2007/chc07/chc07.htm.

[14] U.S. EPA. 2004. Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, NR-005c. EPA420-P-04-005. April 2004. Available at: http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10001T3.pdf.

[15] U.S. EPA. 2010. Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, NR-005d. EPA-420-R-10-016. July 2010. Available at: http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10081RV.pdf

of marine vessel emissions, including the cities of Los Angeles and Long Beach, the state of California, and the U.S. EPA.

4.5 Summary of Project Emissions

Table 5 presents the potential emissions for each phase of the Project, and includes emissions generated by the backup diesel generator engines on the FLiDAR buoys, which are considered to be the only OCS sources, as well as the emissions associated with the marine vessels servicing the Project. Supplemental tables that present equipment specifications, emission factors, and potential emissions for the Project in a format requested by EPA are also presented in Appendix C.

The basic calculation methodology used for estimating the potential emissions is:

$$E = ER \times Act \times LF \times EF$$

Where:

E = Emission rate
ER = Engine rating
Act = activity, hours/year
LF = engine load factor (for the activity)
EF = emission factor

For the workboat main and auxiliary engines, as well as the support vessel main engines, emissions for all criteria pollutants and GHGs were estimated using the emission factors for harbor craft vessels presented in Table 3-8 of the ICF International report, "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories," April 2009. Emissions of HAPs from the marine vessels were estimated using the methodology identified by U.S. EPA for the 2011 National Emissions Inventory (NEI), which calculate emissions of each specific HAP compound as a fraction of either the PM_{10}, $PM_{2.5}$, or VOC emissions from the vessel. CO_2e emissions were calculated using the global warming potentials for CH_4 and N_2O presented in Table A-1 of 40 CFR 98.

For the FLiDAR buoy backup generator engines, emissions were based on the manufacturer's certified emission rates for NOx, VOC, CO, and PM, while greenhouse gas emissions were estimated using emission factors presented in 40 CFR 98, Tables C-1 and C-2, for CO_2, CH_4, and N_2O. CO_2e emissions were calculated using the global warming potentials for CH_4 and N_2O presented in Table A-1 of 40 CFR 98. Organic HAP emissions for the FLiDAR buoy emergency generator engines were calculated using the factors presented in Table 3.2-3 of EPA's AP-42 Compilation of Air Pollutant Emission Factors. Metallic HAP emissions were determined using factors presented in the paper, "Survey of Ultra-Trace Metals in Gas Turbine Fuels," 11th Annual International Petroleum Conference, Oct 12-15, 2004.

Based on correspondence with Northstar Marine, Inc., the Detroit engine that will provide hydraulic power for the winch, crane, and A-frame on the workboat is certified for land-based use, so it has been presumed to meet any applicable emission standards for stationary land-based engines under 40 CFR 60 Subpart IIII. Emissions of NOx, VOC, CO, and PM were calculated using the Subpart IIII emission standards for pre-2007 non-emergency engines rated between 100 and 175 hp (75 and 130 kW). Emissions of CO_2, CH_4, N_2O, CO_2e, organic HAP, and metallic HAP were calculated using the same emission factors described above for the FLiDAR generator engines.

Table 5. Project Potential Emissions

Activity	Potential Emissions (tons per year)							
	VOC	NO_X	CO	PM/ PM_{10}	$PM_{2.5}$	SO_2	HAPs	GHG (CO_2e)
Project Buoy Deployment (Yr. 1)	0.009	0.23	0.13	0.008	0.008	4.23E-05	0.001	16.2
Quarterly Maintenance Activities (Yrs. 1-2)	0.004	0.14	0.07	0.004	0.004	1.84E-05	0.001	9.9
FLiDAR Backup Generators (Yrs. 1-2)	0.003	0.020	0.005	0.0006	0.0006	3.47E-05	9.15E-05	3.8
Annual Inspection (end of Yr. 1)	0.017	0.45	0.26	0.016	0.015	8.46E-05	0.002	32.5
Decommissioning Activities (end of Yr. 2)	0.009	0.23	0.13	0.008	0.008	4.23E-05	0.001	16.2
Maximum Annual Emissions	**0.033**	**0.84**	**0.47**	**0.028**	**0.027**	**1.80E-04**	**0.004**	**62.5**
Total Project Lifetime Emissions (tons)	**0.048**	**1.22**	**0.68**	**0.040**	**0.038**	**2.75E-04**	**0.007**	**92.4**
Note: The maximum annual emissions assume that the quarterly and annual maintenance activities, the annual inspection, and either the installation or decommissioning activities occur in the same year.								

As shown, potential emissions for the Project will be well below the 250 tpy major source threshold for PSD permitting, as well as the 100 tpy major source threshold for the Title V operating permit program. To ensure that actual Project emissions remain well below these thresholds, Ocean Wind, LLC proposes to track operating time and total fuel use for the marine vessels used during the deployment, operational, and decommissioning phases of the Project. Ocean Wind, LLC also proposes to track operating hours and total fuel use for the FLiDAR buoy backup generator engines.

5 REGULATORY REVIEW AND APPLICABILITY

5.1 Federal Requirements

5.1.1 OCS Air Regulations

The federal OCS air regulations under 40 CFR Part 55 apply to any "OCS source," which is defined to mean any equipment, activity, or facility which emits or has the potential to emit any air pollutant, which is regulated or authorized under the Outer Continental Shelf Lands Act (OCSLA, 43 U.S.C. §1331 et seq.), and which is located on the OCS or in and on waters above the OCS. The definition of "OCS source" includes vessels "only 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. §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."

The only OCS sources subject to regulation for the proposed Project will be the backup diesel generator engines installed on each FLiDAR buoy, along with their associated fuel storage tanks. As discussed above in Subsections 3.5.1 and 3.5.2, the marine vessels proposed to be used for installation, maintenance, and decommissioning of the FLiDAR buoys will not be subject to regulation as OCS sources because: (1) they will not be "attached to the seabed and erected thereon"; and (2) they will have no "stationary source aspects" during the brief periods in which they may be "physically attached" to a deployed FLiDAR buoy. Therefore, in accordance with the definition of "potential emissions" in §55.2, only the marine vessel emissions when operating within 25 nautical miles of the two FLiDAR buoys have been included in the potential emissions for the OCS sources in this OCS air permit application.

To determine what additional requirements may apply to the Project's OCS sources, the Corresponding Onshore Area (COA) must first be determined. Because the Project will meet the definition of an "exploratory OCS source" under §55.2, and will be located within 25 nautical miles of a state's seaward boundary, the Nearest Onshore Area (NOA) will automatically be designated as the COA in accordance with §55.5(a). The nearest onshore areas to the proposed Project are located in Cape May County and Atlantic County, New Jersey. Therefore, the state of New Jersey will be the COA for the Project.

Under 40 CFR 55, OCS sources located within 25 miles[16] of a state's seaward boundaries are subject to the same requirements as stationary sources located onshore in the COA, as described in 40 CFR §55.13 and §55.14. The Project buoy deployment sites are respectively located approximately 12 nautical miles southeast of Strathmere, New Jersey, and 18 nautical miles due south of Atlantic City, which are within 25 miles of New Jersey's seaward boundaries and, therefore, subject to the permit requirements specified in §55.6(b) and (c), but not (d).

5.1.2 New Source Performance Standards

As discussed in Section 4, the FLiDAR buoy engines will be designated as stationary engines subject to the New Source Performance Standards (NSPS) at 40 CFR 60 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. Owners and operators of engines subject to Subpart IIII must purchase engines that comply with the applicable standards for a given model year, total power rating, and displacement per cylinder. The Yanmar 2TNV70 engines that will be installed on the FLiDAR buoys are certified by the manufacturer to meet Subpart IIII standards for post-2007 emergency engines rated between 11 and 25 horsepower (8 and 19 kW). As discussed in section 4.1, EPA may determine that the FLiDAR buoy engines should be considered non-emergency engines based on their proposed operation; or that the engines should be subject to the Subpart IIII standards that apply to their derated power output, rather than their original rated output; or both. The Yanmar 2TNV70 engines are capable of meeting any of the Subpart IIII emission standards that EPA determines may apply.

5.1.3 National Emission Standards for Hazardous Air Pollutants

New stationary internal combustion engines are potentially subject to requirements under 40 CFR 63 Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines. However, Subpart ZZZZ states that if an engine satisfies the NSPS requirements under 40 CFR 60 Subpart IIII, it is not subject to any further requirements under 40 CFR 63 Subpart ZZZZ.

5.1.4 Fuel Standards

Engines that are subject to the NSPS requirements under 40 CFR 60 Subpart IIII are also required to meet the fuel sulfur standards under 40 CFR §80.510, which limit sulfur content to 15 parts per million by weight

[16] The regulation does not specify whether these miles are statute miles or nautical miles; they have conservatively been interpreted as nautical miles for the purpose of this OCS air permit application.

(0.0015 percent by weight), beginning on July 1, 2012. The FLIDAR buoy engines will use ultra-low sulfur diesel (ULSD) fuel oil with a maximum sulfur content of 0.0015 percent by weight as their only fuel.

The marine vessels proposed to be used for the Project will use marine diesel fuel oil. The Project will be located in the North American Emission Control Area (ECA), which was established by the International Maritime Organization (IMO) in their International Convention on the Prevention of Pollution from Ships (MARPOL). This ECA extends seaward from the U.S. coastline out to 200 nautical miles (230 statute miles) from land, and beginning on January 1, 2015, the maximum fuel sulfur limit for fuels used by marine vessels within the ECA was reduced to 0.1 percent by weight. Additionally, EPA's June 1, 2012 limit of 0.0015 percent by weight, as established under 40 CFR §80.510, applies to all diesel fuel sold in the U.S. Therefore, U.S.-based vessels and foreign-based vessels fueling at U.S. ports will use ULSD fuel oil with a maximum sulfur content of 0.0015 percent by weight.

If any vessels were traveling to the Project site from non-U.S. ports they would be required, at a minimum, to use fuel oil that complies with the ECA fuel oil sulfur limit of 0.1 percent by weight. However, in the event that such a vessel were to become an OCS source (by becoming physically attached to an OCS facility), it would then be required to meet the U.S. EPA fuel requirement of 0.0015 percent sulfur by weight while operating as an OCS source. None of the marine vessels to be used for the Project will qualify as OCS sources.

5.1.5 New Source Review and Prevention of Significant Deterioration

New Source Review (NSR) applies to proposed new major sources of air pollutants and major modifications of existing major sources. The NSR program for major sources includes two distinct permitting programs, Prevention of Significant Deterioration (PSD) permitting for projects located in areas designated as unclassified or attainment with the National Ambient Air Quality Standards (NAAQS), and Nonattainment New Source Review (NNSR) permitting for projects located in areas designated as nonattainment with the NAAQS. The Project's potential emissions will be well below major source thresholds for all pollutants, and will not be subject to NSR or PSD permitting.

5.1.6 Title V Operating Permit Program

Stationary sources may be subject to the Title V operating permit program if they have potential emissions of 100 tpy or greater for any single criteria pollutant, of 10 tpy or greater for any individual HAP compound, or 25 tpy or greater for all HAPs combined. The Project's potential emissions will be well below these thresholds for all pollutants, and will not be subject to Title V permitting.

5.1.7 General Conformity

General Conformity requirements apply to certain federal actions that would result in increased emissions in areas designated as "nonattainment" or "maintenance" with respect to the NAAQS. The closest points of land to the Project buoy deployment locations are located in Cape May County and Atlantic County, New Jersey. Each of these counties has been designated as moderate nonattainment with respect to the 1997 8-hour ozone (O_3) standard in the revised NAAQS, and as marginal nonattainment with respect to the 2008 8-hour O_3 standard. In addition, New Jersey is located within the northeast Ozone Transport Region. Given these designations, if the Project's potential emissions (not otherwise authorized by an air permit) equaled or exceeded 100 tpy of NOx, or 50 tpy of VOC, then a determination of General Conformity would be required prior to any federal action authorizing the Project. The Project's potential emissions will be well below these thresholds, and therefore a General Conformity determination will not be required.

5.1.8 Environmental Justice

Prior to issuing Lease OCS-A 0498, BOEM prepared an Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia (Mid-Atlantic EA), which considered Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (BOEM, 2012). Ocean Wind, LLC demonstrates consistency between the activity considered by BOEM in the Mid-Atlantic EA with the proposed equipment and methodologies in Section 2 of the Ocean Wind Site Assessment Plan. Section 4.1.3.4 of the Mid-Atlantic EA specifically addresses Environmental Justice and is incorporated by reference and not repeated. BOEM concluded that, "Due to the distance from shore [the proposed buoy actions are] not expected to have disproportionately high or adverse environmental or health effects on minority or low-income populations."

5.1.9 Public Outreach

Ocean Wind, LLC seeks to ensure the public and affected stakeholders are aware of the proposed work and able to provide comments. For example, Ocean Wind, LLC has engaged a Fisheries Liaison Officer (FLO), who has been actively engaging with the commercial and recreational fishing industry in New Jersey. Furthermore, Fisheries Industry Representatives (FIR) participated in offshore survey activity in late 2017. Prior to the buoy deployment, Ocean Wind, LLC will supply the U.S. Coast Guard with a Local Notice to Mariners to be published with information regarding the timing and location of deployment activities.

5.1.10 Other Statutes

Prior to installation of the Met Buoys, Ocean Wind, LLC will obtain all required permits and approvals from various jurisdictional agencies as identified in Table 6 below.

Table 6. Status of Compliance with Other Potentially Applicable Statutes

Permitting Agency	Applicable Permit or Approval	Statutory Basis	Regulations	Applicable Requirements
Bureau of Ocean Energy Management	Site Assessment Plan	Energy Policy Act of 2005, 43 United States Code (U.S.C.) 1337	30 CFR 585	Ocean Wind LLC has submitted a Site Assessment Plan (SAP) to BOEM, which is currently under review. BOEM has notified Ocean Wind LLC that the SAP is sufficient and complete. Section 2 of the SAP demonstrates consistency between the activities proposed by Ocean Wind LLC and those considered by BOEM in the Mid-Atlantic EA (BOEM, 2012).
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS)	Endangered Species Act Section 7 Consultation	16 U.S.C. 1536	50 CFR 402	No Action Required. These consultations were completed by BOEM (Lessor) on behalf of Ocean Wind LLC (Lessee).
	Magnuson-Stevens Fishery Conservation and Management Act Section 305(b) Consultation	16 U.S.C. 1801	50 CFR 600	No Action Required. These consultations were completed by BOEM (Lessor) on behalf of Ocean Wind LLC (Lessee).
	Incidental Take Authorization	Marine Mammal Protection Act of 1972(MMPA)	16 U.S.C. §§ 1361 *et seq.*	No action required. Installation, operation, and decommissioning of the Met Buoys will not result in the harassment of marine mammals protected under the MMPA.
U.S. Army Corps of Engineers, Philadelphia District	Nationwide Permit 5 – Scientific Measuring Devices	Clean Water Act 33 U.S.C.134	33 CFR 320 *et seq.*	Ocean Wind LLC filed form #4345 with the United States Army Corps of Engineers documenting eligibility under and conformance with the terms of the Nationwide Permit on September 12, 2017.
United States Coast Guard (USCG)	Approval for Private Aids to Navigation	14 U.S.C. 81	33 CFR Part 66	Ocean Wind LLC will submit an application to the USCG for a Private Aids to Navigation (PATON) prior to the installation of the Met Buoys.
U.S. Department of Interior, BOEM	NHPA Section 106 Consultation	NHPA 16 U.S.C. 470	36 CFR Part 60, Part 800	No action required. BOEM (Lessor) has executed a Programmatic Agreement that establishes procedures for consultations for site assessment activities in the New Jersey Wind Energy Area (WEA) and under NHPA Stipulations for the identification and protection of cultural resources are included in the Lease.
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 Consultation	16 U.S.C. 1536	50 CFR 402	No Action Required. These consultations were completed by BOEM (Lessor) on behalf of Ocean Wind LLC (Lessee).
New Jersey Department of Environmental Protection	Coastal Zone Program Consistency Certification	Coastal Zone Management Act	15 CFR 930 Subpart C	No action required. A final Coastal Zone Consistency Determination was issued to BOEM (Lessor) for the proposed activity.

5.2 New Jersey State Requirements

Air pollution control regulations have been established by the New Jersey Department of Environmental Projection (NJDEP) under Title 7, Chapter 27 of the New Jersey Administrative Code (N.J.A.C. 7:27) for air emissions associated with stationary sources. The only stationary sources of emissions for the Project will be the backup diesel generator engines installed on each FLiDAR buoy, along with their associated fuel storage tanks.

5.2.1 N.J.A.C. 7:27-1 General Provisions

The proposed Project will be subject to general provisions under N.J.A.C. 7:27-1, which sets forth provisions such as definitions, procedures for claiming confidential information, the right of NJDEP representatives to enter and inspect subject facilities, and the requirement for information submitted to NJDEP to be certified by a responsible official.

5.2.2 N.J.A.C. 7:27-3 Control and Prohibition of Smoke from Combustion of Fuel

The FLiDAR buoy engines will be prohibited under N.J.A.C. 7:27-3.5 from emitting smoke which is darker than number 1 on the Ringelmann smoke chart or greater than 20 percent opacity, exclusive of visible condensed water vapor, for a period of more than 10 consecutive seconds.

Visible emissions from all marine vessel engines associated with the proposed Project will also be subject to the standard for marine installations under N.J.A.C. 7:27-3.3, which prohibits the emission of smoke which is darker than number 1 on the Ringelmann smoke chart or greater than 20 percent opacity, exclusive of visible condensed water vapor, for a period of more than three minutes in any consecutive 30-minute period.

5.2.3 N.J.A.C. 7:27-4 Control and Prohibition of Particles from Combustion of Fuel

The FLiDAR buoy engines will be subject to a maximum allowable emission rate for particulate matter, as set forth under N.J.A.C. 7:27-4.2(a). Based on each FLiDAR buoy engine's derated heat input of 0.047 million Btu per hour (MMBtu/hr), the maximum allowable particulate emission rate under N.J.A.C. 7:27-4.2(a) is 0.028 lb/hr. Each FLiDAR buoy engine will have a maximum PM emission rate of 0.002 lb/hr, which complies with the requirement in this subchapter.

5.2.4 N.J.A.C. 7:27-5 Prohibition of Air Pollution

The proposed Project will be subject to the general prohibition under N.J.A.C. 7:27-5.2, which states that "no person shall cause, suffer, allow or permit to be emitted into the outdoor atmosphere substances in quantities which shall result in air pollution as defined herein."

Air pollution is defined under N.J.A.C. 7:27-5.1 as "the presence in the outdoor atmosphere of one or more air contaminants in such quantities and duration as are, or tend to be, injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property throughout the State and in such territories of the State as shall be affected thereby and excludes all aspects of employer-employee relationship as to health and safety hazards."

5.2.5 N.J.A.C. 7:27-8 Permits and Certificates for Minor Facilities

The FLiDAR buoy engines will be exempt from the minor source permitting program at N.J.A.C. 7:27-8, because they will each have a heat input rating of less than 1,000,000 Btu per hour, and therefore will not qualify as significant sources. The fuel oil storage tanks for the FLiDAR buoy engines will also be exempt from permitting under N.J.A.C. 7:27-8 because they will each have a capacity of 900 liters (238 gallons), which is less than the permitting threshold of 2,000 gallons.

5.2.6 N.J.A.C. 7:27-9 Sulfur in Fuels

The fuel used in the FLiDAR buoy engines will be limited to a maximum allowable sulfur content of 15 parts per million by weight (equivalent to 0.0015 percent by weight), as set forth in Table 1A to N.J.A.C. 7:27-9.2.

Fuel used in ocean-going vessels is exempt from these sulfur in fuel standards, as set forth in N.J.A.C. 7:27-9.3.

5.2.7 N.J.A.C. 7:27-16 Control and Prohibition of Air Pollution by Volatile Organic Compounds

The fuel oil storage tanks for the FLiDAR buoy engines will be exempt from the requirements set forth under N.J.A.C. 7:27-16.2, because they each have a maximum capacity of less than 2,000 gallons.

5.2.8 N.J.A.C. 7:27-18 Control and Prohibition of Air Pollution from New or Altered Sources Affecting Ambient Air Quality (Emission Offset Rules)

The proposed Project will be exempt from the requirements of this subchapter, because its potential emissions (including stationary source and marine vessel emissions), are below the applicability thresholds set forth under N.J.A.C. 7:27-18.2, as shown in Table 7 below.

Table 7. New Jersey Emission Offset Rules Applicability

Pollutant	Project Potential Emissions (tpy)	N.J.A.C. 7:27-18 Threshold (tpy)	Subject to Rule?
CO	0.47	100	No
PM_{10}	0.028	100	No
$PM_{2.5}$	0.027	100	No
TSP	0.028	100	No
SO_2	1.80E-04	100	No
NO_x	0.84	25	No
VOC	0.033	25	No
Lead (Pb)	Negligible	10	No

5.2.9 N.J.A.C. 7:27-19 Control and Prohibition of Air Pollution by Oxides of Nitrogen

The FLiDAR buoy engines will be exempt from the requirements of this subchapter, because their rated output is below the applicability threshold of 500 brake horsepower, as set forth under N.J.A.C. 7:27-19.2.

5.2.10 N.J.A.C. 7:27-21 Emission Statements

The proposed Project will be exempt from the requirements of this subchapter, because its potential emissions (including stationary source and marine vessel emissions), are below the applicability thresholds set forth under N.J.A.C. 7:27-21.2, as shown in Table 8 below.

Table 8. New Jersey Emission Statement Applicability

Pollutant	Project Potential Emissions (tpy)	Emission Statement Reporting Threshold (tpy)	Required to Report?
VOC	0.033	10	No
NO_x	0.84	25	No
CO	0.47	100	No
SO_2	1.80E-04	100	No
TSP	0.028	100	No
$PM_{2.5}$	0.027	100	No
PM_{10}	0.028	100	No
Ammonia (NH_3)	0	100	No
Lead (Pb)	Negligible	5	No

5.2.11 N.J.A.C. 7:27-22 Operating Permits

An entire facility may be subject to air permitting under the major source operating permit program at N.J.A.C. 7:27-22 if it has potential emissions of at least 25 tpy for NO_x or VOC, 10 tpy of lead, or 100 tpy of any remaining criteria pollutant, or if it has potential emissions of at least 10 tpy for any individual HAP compound, or 25 tpy for all HAPs combined. The Project's overall potential emissions will be well below these thresholds for all pollutants, and will not be subject to major source permitting under N.J.A.C. 7:27-22.

Figures

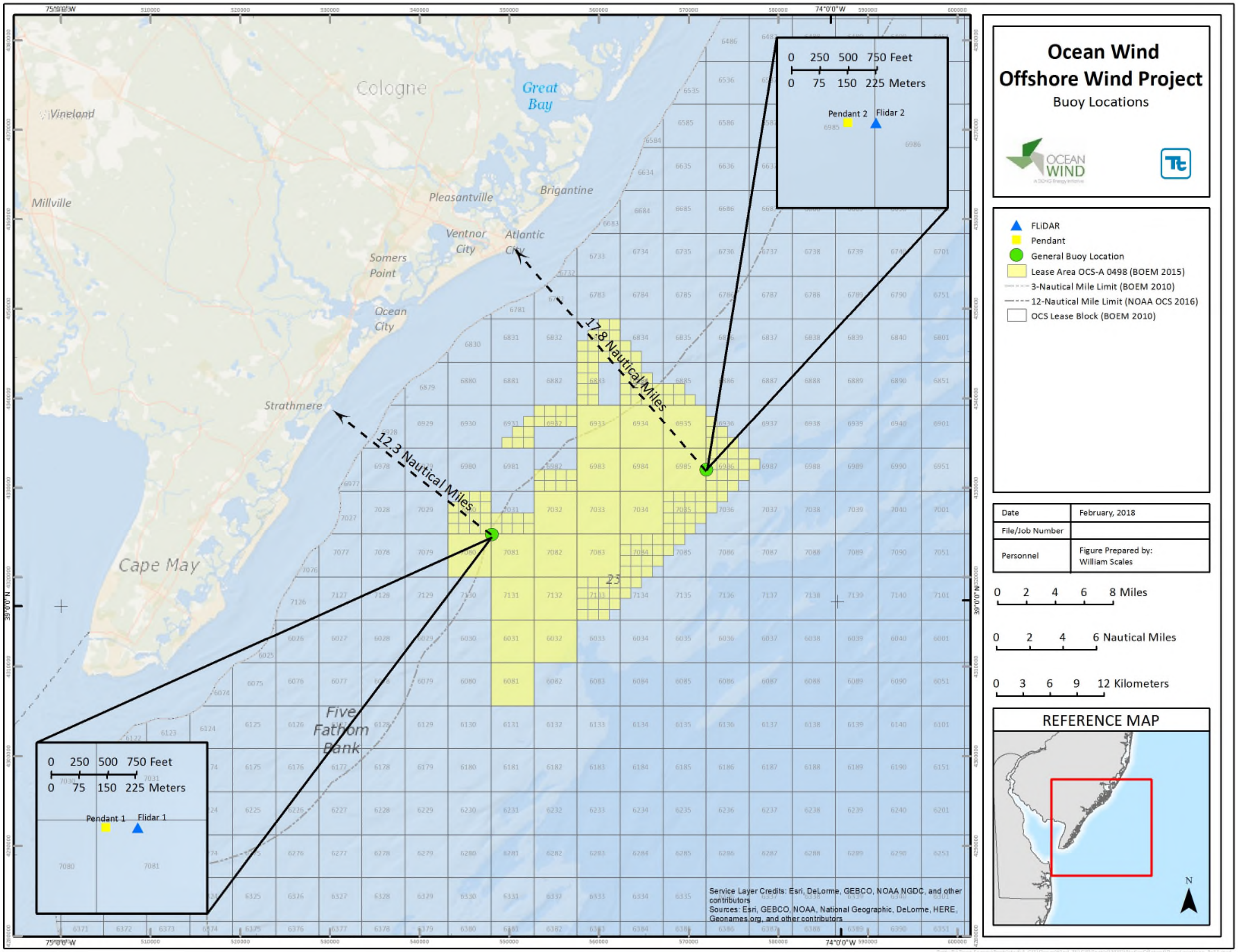

Figure 1. Meteorological Buoy Deployment Area

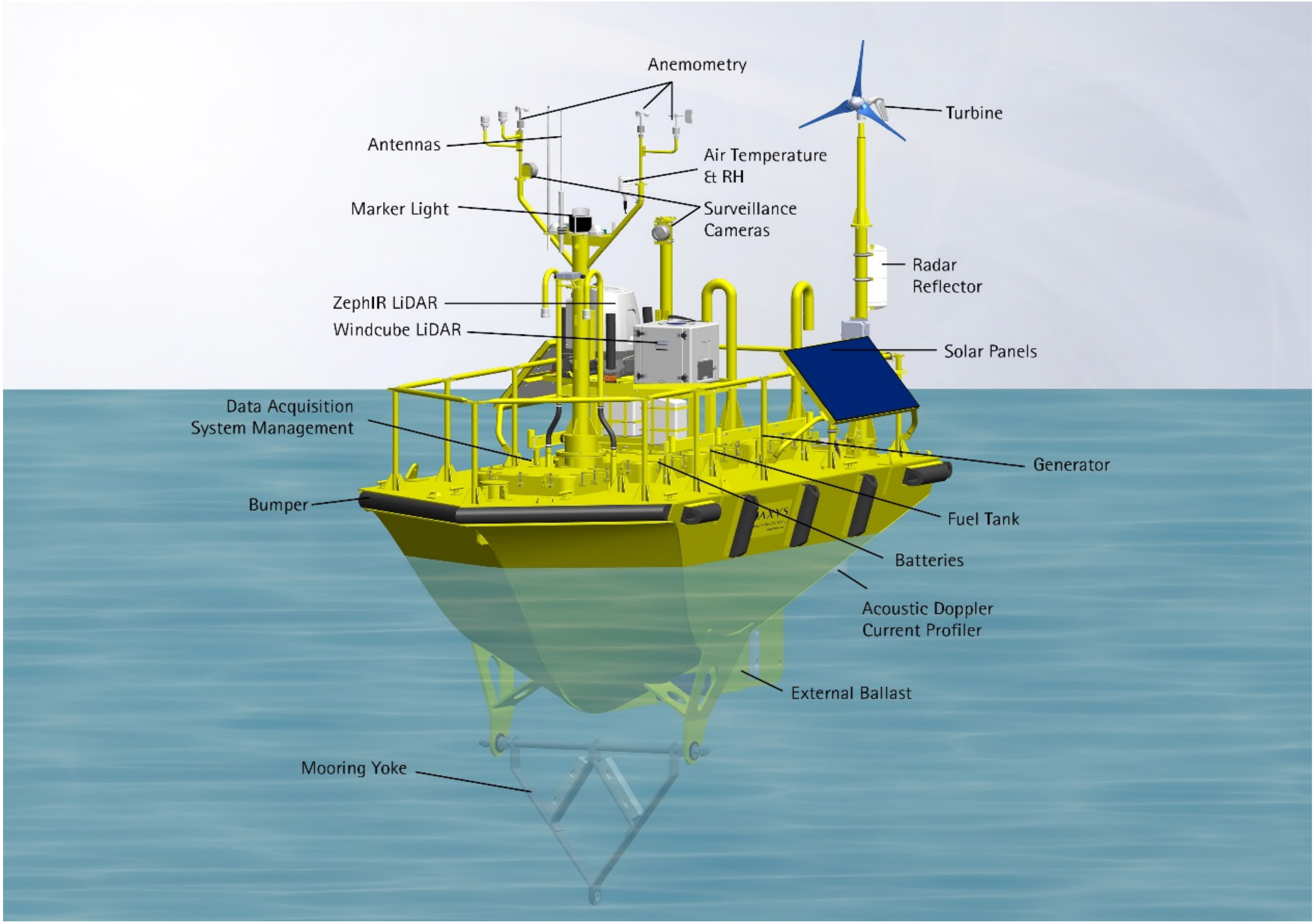

Figure 2. WindSentinel™ FLiDAR Buoy

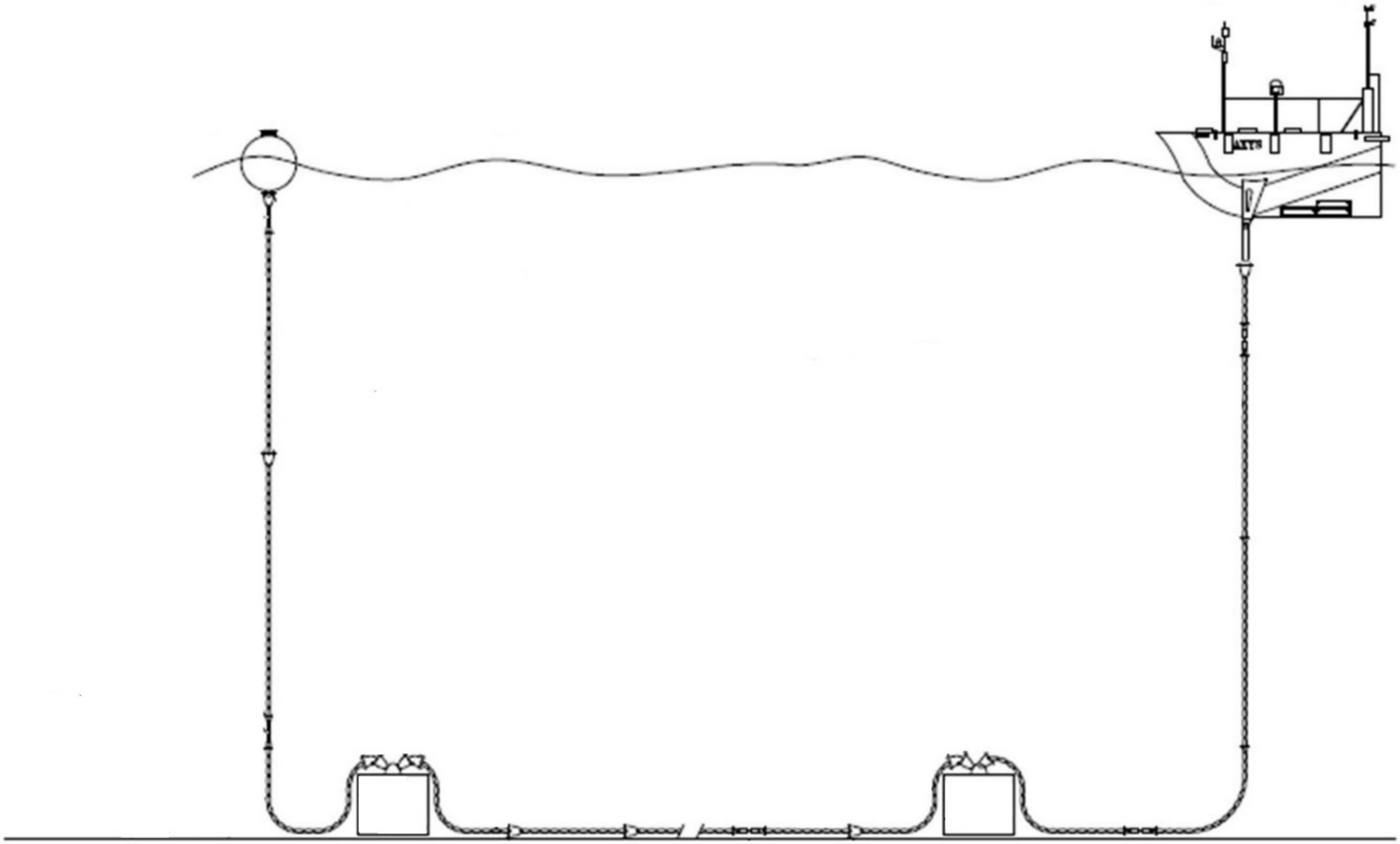

Figure 3. WindSentinel™ FLiDAR U-Mooring Design

Appendix A

Emission Calculations

OCEAN WIND OFFSHORE WIND FARM
Air Emission Calculations
Emission Summary - FLiDAR Buoy Deployment

Met Facilities Activity	VOC tpy	NO_X tpy	CO tpy	PM/PM_{10} tpy	$PM_{2.5}$ tpy	SO_2 tpy	HAPs tpy	GHG tpy CO_2e
Deployment Activities (yr. 1)	0.009	0.23	0.13	0.008	0.008	4.23E-05	0.001	16.2
Quarterly Maintenance Activities (yrs. 1-2)	0.004	0.14	0.07	0.004	0.004	1.84E-05	0.001	9.9
FLiDAR Backup Generators (yrs. 1-2)	0.003	0.020	0.005	0.0006	0.0006	3.47E-05	9.15E-05	3.8
Annual Inspection (end of yr. 1)	0.017	0.45	0.26	0.016	0.015	8.46E-05	0.002	32.5
Decommissioning Activities (End of Yr. 2)	0.009	0.23	0.13	0.008	0.008	4.23E-05	0.001	16.2
Maximum Annual Emissions [1]	0.033	0.84	0.47	0.028	0.027	1.80E-04	0.004	62.5
Total Project Lifetime Emissions (tons)	**0.048**	**1.22**	**0.68**	**0.040**	**0.038**	**2.75E-04**	**0.007**	**92.4**

Note:
1. The maximum annual emissions assume that the quarterly and annual maintenance activities, the annual inspection, and either the installation or decommissioning activities occur in the same year.

OCEAN WIND OFFSHORE WIND FARM - AIR EMISSION CALCULATIONS
FLIDAR Buoy Backup Generators

Generator Engine Data

Manufacturer	Yanmar	
Model	2TNV70	
Engine Type	4 cycle, 2 cylinder diesel	
Original rated power output	kW	10
Original rated power output	bhp	13.4
Derated power output	kW	3.5
Derated power output	bhp	4.7
Total displacement	L	0.57
Number of cylinders	cyl	2
Displacement per cylinder	L/cyl	0.29
Engine speed	rpm	3600

Fuel Use Assumptions

Fuel consumption at 100% load	gal/hr	0.33
Heat input rate	MMBtu/hr (HHV)	0.047
Number of generators (total both buoys)	engines	2
Annual operating hours per generator	hr/yr	500
Annual fuel usage per generator	gal/yr	163

Fuel Data

Fuel type	Ultra low sulfur diesel	
Fuel heat content	Btu/lb (LHV)	19,300
Fuel heat content	Btu/lb (HHV)	20,316
Fuel density	lb/gal	7.1
Fuel sulfur content	% weight	0.0015
Conversion factor	LHV/HHV	0.95

Engine Emission Factors

NOx	g/hp-hr	3.92
CO	g/hp-hr	0.97
HC (VOC)	g/hp-hr	0.55
PM/PM10	g/hp-hr	0.11
PM2.5	g/hp-hr	0.11
SO2	lb/MMBtu (HHV)	0.0015
HAP	lb/MMBtu (HHV)	0.0039
CO2	lb/MMBtu (HHV)	163.1
CH4	lb/MMBtu (HHV)	0.007
N2O	lb/MMBtu (HHV)	0.001

Engine Emission Estimates

NOx	lb/hr (per engine)	0.04
CO	lb/hr (per engine)	0.01
VOC	lb/hr (per engine)	0.006
PM10	lb/hr (per engine)	0.001
PM2.5	lb/hr (per engine)	0.001
SO2	lb/hr (per engine)	6.94E-05
HAP	lb/hr (per engine)	1.83E-04
CO2	lb/hr (per engine)	7.7
CH4	lb/hr (per engine)	3.11E-04
N2O	lb/hr (per engine)	6.22E-05
CO2e	lb/hr (per engine)	7.7

	Annual Emissions Per Engine (tons/yr)	Annual Emissions for Both Engines (tons/yr)
NOx	0.010	0.020
CO	0.003	0.005
VOC	0.0014	0.003
PM10	0.0003	0.0006
PM2.5	0.0003	0.0006
SO2	1.74E-05	3.47E-05
HAP	4.57E-05	9.15E-05
CO2	1.92	3.83
CH4	7.78E-05	1.56E-04
N2O	1.56E-05	3.11E-05
CO2e	1.92	3.85

Notes:
1. Engine power rating and displacement are based on manufacturer specification sheet.
2. Fuel consumption is based on manufacturer estimated fuel use of 300 g/kWh at 3600 rpm.
3. It is assumed these engines will be limited to no more than 500 hours per year, including maintenance and testing.
4. Emission factors for NOx, CO, VOC, and PM are based on actual vendor data, and are compliant with EPA 2008 Tier 4 standards for engines 25 hp (5.6 g/hp-hr NOx+HC; 4.9 g/hp-hr CO; 0.3 g/hp-hr PM). The vendor-provided NOx+HC rate was apportioned into NOx and VOC rates bas of Tier 1 limits (9.2 g/kWh NOx and 1.3 g/kWh HC).
5. All particulate (PM) is assumed to be ≤ to 10 µm (PM10) and 97% of the PM is assumed to be smaller than 2.5 µm (PM2.5) based on US EPA and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, No. NR-0009d, July 2010.
6. SO2 emission factor calculated from mass balance for 0.0015% by weight ULSD, assuming 100% conversion of fuel sulfur to SO2.
7. Emission factors used to calculate emission rates for CO2 (73.96 kg/MMBtu), CH4 (0.003 kg/MMBtu) and N2O (0.0006 kg/MMBtu) were ba and C-2 of 40 CFR Part 98 - Mandatory Greenhouse Gas Reporting, Subpart C - General Stationary Fuel Combustion Sources.
8. CO2e emission rates use the following carbon equivalence factors: 25 for CH4, and 298 for N2O.

OCEAN WIND OFFSHORE WIND FARM
Air Emission Calculations
Marine Vessel Emissions - FLiDAR Buoy Deployment

														Total Emissions										
Vessels/Equipment	**No. of Engines per vessel**	**Dimensions (ft) length x breadth x draft**	**Emission Factor Used (see EFs worksheet)**	**Activity**	**Engine Rating (hp)**	**Fuel Type**	**Trips**	**Hrs/trip**	**Operating Days**	**Operating Hours (hrs/day)**	**Total Vessel Operating Hours (hrs)**	**Average load (%)**	**Fuel Usage Gallons**	**VOC tons**	**NO_X tons**	**CO tons**	**PM_{10} tons**	**$PM_{2.5}$ tons**	**SO_2 tons**	**HAPs tons**	**CO_2 tons**	**CH_4 tons**	**N_2O tons**	**CO_2e tons**
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Deploying FLIDAR 1																				
- main engines	2		2		450	Diesel	1	3	1	12	15	43%	292.7	1.29E-03	0.05	0.02	1.23E-03	1.19E-03	6.21E-06	2.65E-04	3.29	4.30E-04	9.55E-05	3.33
- aux. generator	1		2		87	Diesel	1	3	1	12	15	43%	28.3	1.25E-04	4.52E-03	2.31E-03	1.19E-04	1.15E-04	6.00E-07	2.56E-05	0.32	4.15E-05	9.23E-06	0.32
- aux. engine	1		205		120	Diesel	0	0	1	12	12	100%	72.0	1.54E-03	1.09E-02	1.35E-02	1.18E-03	1.15E-03	7.56E-06	1.96E-05	0.82	3.33E-05	6.67E-06	0.82
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Deploying FLIDAR 1																				
- main engines	2		2		425	Diesel	1	3	1	12	15	45%	289.3	1.27E-03	0.05	0.02	1.22E-03	1.18E-03	6.13E-06	2.62E-04	3.26	4.25E-04	9.44E-05	3.29
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Deploying FLIDAR 2																				
- main engines	2		2		450	Diesel	1	4.5	1	12	16.5	43%	321.9	1.42E-03	0.05	0.03	1.35E-03	1.31E-03	6.83E-06	2.92E-04	3.62	4.73E-04	1.05E-04	3.67
- aux. generator	1		2		87	Diesel	1	4.5	1	12	16.5	43%	31.1	1.37E-04	4.97E-03	2.54E-03	1.31E-04	1.27E-04	6.60E-07	2.82E-05	0.35	4.57E-05	1.02E-05	0.35
- aux. engine	1		205		120	Diesel	0	0	1	12	12	100%	72.0	1.54E-03	1.09E-02	1.35E-02	1.18E-03	1.15E-03	7.56E-06	1.96E-05	0.82	3.33E-05	6.67E-06	0.82
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Deploying FLIDAR 2																				
- main engines	2		2		425	Diesel	1	4.5	1	12	16.5	45%	318.2	1.40E-03	0.05	0.03	1.34E-03	1.30E-03	6.75E-06	2.88E-04	3.58	4.67E-04	1.04E-04	3.62
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Quarterly maintenance (year 1)																				
- main engines	2		2		425	Diesel	3	5	3	10	45	45%	867.8	3.82E-03	0.14	0.07	3.65E-03	3.54E-03	1.84E-05	7.86E-04	9.77	1.27E-03	2.83E-04	9.88
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Quarterly maintenance (year 2)																				
- main engines	2		2		425	Diesel	3	5	3	10	45	45%	867.8	3.82E-03	0.14	0.07	3.65E-03	3.54E-03	1.84E-05	7.86E-04	9.77	1.27E-03	2.83E-04	9.88
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Annual maintenance FLIDAR 1																				
- main engines	2		2		450	Diesel	2	3	2	12	30	43%	585.3	2.58E-03	0.09	0.05	2.46E-03	2.39E-03	1.24E-05	5.30E-04	6.59	8.59E-04	1.91E-04	6.67
- aux. generator	1		2		87	Diesel	2	3	2	12	30	43%	56.6	2.49E-04	0.01	4.61E-03	2.38E-04	2.31E-04	1.20E-06	5.13E-05	0.64	8.31E-05	1.85E-05	0.64
- aux. engine	1		205		120	Diesel	0	0	2	12	24	100%	144.0	3.08E-03	2.18E-02	2.70E-02	2.37E-03	2.30E-03	1.51E-05	3.92E-05	1.64	6.67E-05	1.33E-05	1.65
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Annual maintenance FLIDAR 1																				
- main engines	2		2		425	Diesel	2	3	2	12	30	45%	578.5	2.55E-03	0.09	0.05	2.43E-03	2.36E-03	1.23E-05	5.24E-04	6.51	8.49E-04	1.89E-04	6.59
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Annual maintenance FLIDAR 2																				
- main engines	2		2		450	Diesel	2	4.5	2	12	33.0	43%	643.9	2.84E-03	0.10	0.05	2.71E-03	2.63E-03	1.37E-05	5.83E-04	7.25	9.45E-04	2.10E-04	7.33
- aux. generator	1		2		87	Diesel	2	4.5	2	12	33	43%	62.2	2.74E-04	9.95E-03	5.08E-03	2.62E-04	2.54E-04	1.32E-06	5.64E-05	0.70	9.14E-05	2.03E-05	0.71
- aux. engine	1		205		120	Diesel	0	0	2	12	24	100%	144.0	3.08E-03	2.18E-02	2.70E-02	2.37E-03	2.30E-03	1.51E-05	3.92E-05	1.64	6.67E-05	1.33E-05	1.65
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Annual maintenance FLIDAR 2																				
- main engines	2		2		425	Diesel	2	4.5	2	12	33	45%	636.4	2.80E-03	0.10	0.05	2.68E-03	2.60E-03	1.35E-05	5.76E-04	7.16	9.34E-04	2.08E-04	7.25
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Decommissioning FLIDAR 1																				
- main engines	2		2		450	Diesel	1	3	1	12	15	43%	292.7	1.29E-03	0.05	0.02	1.23E-03	1.19E-03	6.21E-06	2.65E-04	3.29	4.30E-04	9.55E-05	3.33
- aux. generator	1		2		87	Diesel	1	3	1	12	15	43%	28.3	1.25E-04	4.52E-03	2.31E-03	1.19E-04	1.15E-04	6.00E-07	2.56E-05	0.32	4.15E-05	9.23E-06	0.32
- aux. engine	1		205		120	Diesel	0	0	1	12	12	100%	72.0	1.54E-03	1.09E-02	1.35E-02	1.18E-03	1.15E-03	7.56E-06	1.96E-05	0.82	3.33E-05	6.67E-06	0.82
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Decommissioning FLIDAR 1																				
- main engines	2		2		425	Diesel	1	3	1	12	15	45%	289.3	1.27E-03	0.05	0.02	1.22E-03	1.18E-03	6.13E-06	2.62E-04	3.26	4.25E-04	9.44E-05	3.29
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Decommissioning FLIDAR 2																				
- main engines	2		2		450	Diesel	1	4.5	1	12	16.5	43%	321.9	1.42E-03	0.05	2.63E-02	1.35E-03	1.31E-03	6.83E-06	2.92E-04	3.62	4.73E-04	1.05E-04	3.67
- aux. generator	1		2		87	Diesel	1	4.5	1	12	16.5	43%	31.1	1.37E-04	4.97E-03	2.54E-03	1.31E-04	1.27E-04	6.60E-07	2.82E-05	0.35	4.57E-05	1.02E-05	0.35
- aux. engine	1		205		120	Diesel	0	0	1	12	12	100%	72.0	1.54E-03	1.09E-02	1.35E-02	1.18E-03	1.15E-03	7.56E-06	1.96E-05	0.82	3.33E-05	6.67E-06	0.82
Support vessel (Northstar Enterprise or similar)		41' x 13.5' x 4'		Decommissioning FLIDAR 2																				
- main engines	2		2		425	Diesel	1	4.5	1	12	16.5	45%	318.2	1.40E-03	0.05	0.03	1.34E-03	1.30E-03	6.75E-06	2.88E-04	3.58	4.67E-04	1.04E-04	3.62
													7,437.3	**0.04**	**1.18**	**0.67**	**0.04**	**0.04**	**2.06E-04**	**6.37E-03**	**83.8**	**1.03E-02**	**2.29E-03**	**84.7**

Notes:
1. One separate round trip per vessel will be required to install each FLIDAR buoy.
2. Two separate round trips per vessel will be required for annual maintenance on each FLIDAR buoy.
3. One separate round trip per vessel will be required to decommission each FLIDAR buoy.
4. Quarterly maintenance activities will be performed in three out of four calendar quarters. The fourth quarter trip will be either annual maintenance (year 1) or decommissioning (year 2).
5. Trip time constitutes the round trip transit time to and from the project site. The number of hours per trip were estimated based on an assumed transit speed of 10 knots, and additional time required for maneuvering and berthing. Round trip distances are estimated to be: 28 nm for FLIDAR 1 deployment/ maintenance/ decommissioning; 45nm for FLIDAR 2 deployment/ maintenance/ decommissioning; and 49.5 nm for quarterly maintenance (3-leg trip from port to FLIDAR 1, then FLIDAR 2, then back to port.)
6. Operating days/hours is the estimated time each vessel is at the deployment site performing its associated activities.
7. The auxiliary engine on the work boat powers the winch, crane, and A-frame, and will only operate in the immediate vicinity of each deployment site.
8. Emission calculations based on vessels traveling from Avalon Marine Center.
9. The engines utilized on each of the vessels are assumed to be Category 1 engines based on engine horsepower rating (<1,000 kW) and cylinder displacement (1-5 liters per cylinder).
10. Emission factors for marine vessel engines are from Table 3-8 in the ICF International report to the US EPA "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories", April 2009. (See emission factors summary page) Assumed all engines to be used are certified to meet EPA Tier 1 engine standards; therefore, the Tier 1 emission factors in Table 3-8 from the ICF International report was used to provide conservative estimate.
11. HAP emission factors for commercial marine vessels were determined using the methodology identified by US EPA for the 2011 National Emissions Inventory (NEI); i.e., they are calculated as percentages of the PM_{10}, $PM_{2.5}$, or VOC emissions from the CMVs. The HAP emisson for nonroad engines were based on EPA's AP-42 Volume 1, Chapters 3.3 and 3.4 for small and large diesel engines. (see HAP emission factor summary pages)
12. Average load factors were estimated based on load factors presented in Table 3-4 of the ICF International report.
13. CO_2e emission rates use the following carbon equivalence factors: 25 for CH_4, and 298 for N_2O.

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Emission Factor Summary

Commercial Marine Vessels (CMVs)

	Engine Type	Commercial Marine Vessel Emission Factors (g/hp-hr) /a VOC	NO_x	CO	PM/ PM_{10} /b, /c	$PM_{2.5}$ /b	SO_2 /c	CO_2	CH_4	N_2O	Fuel Cons. (gal/hp-hr) /d
1	Category 2 engines	0.37	7.3	3.73	0.46	0.45	0.0010	515	0.067	0.015	0.050
2	Category 1 engines ≤ 1000 kW	0.20	7.3	3.73	0.19	0.19	0.0010	515	0.067	0.015	0.050
3	Category 3 engines (MSD using MDO) (>30L/cyl.)	0.37	9.8	0.82	0.14	0.13	0.296	482	0.003	0.023	0.046
4	All Categories aux. engines (MSD using MDO)	0.30	10.4	0.82	0.14	0.13	0.316	515	0.003	0.023	0.049

/a Emission factors for Category 1 and 2 engines are from Table 3-8 from ICF International report to the US EPA "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories", April 2009 (converted from g/kW-hr to g/hp-hr by multiplying by 0.746 kW/hp). Assumed all Category 1 and 2 engines to be used are certified to meet EPA Tier 1 and 2 marine engine standards respectively (providing conservative estimate for Category 1 engines); therefore the Tier 1 and 2 emission factors in Table 3-8 from the ICF International report was used. Note, the CO emission factor for Category 1 Tier 2 engines is higher than what is provided for Tier 1 engines, thus the Tier 2 emission factor for CO was used to provide a conservative estimate.

/b All PM is assumed to less than 10 µm in diameter; therefore, PM emission factor is equivalent to PM_{10} emission factor. $PM_{2.5}$ is estimated to be 97 % of PM_{10} per EPA guidance in "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition," EPA420-R-10-018/NR-009d, July 2010.

/c Emission factors for Category 1 and 2 engines for SO_2 and PM_{10} presented in Table 3-8 of the ICF report (ICF International 2009) are based on a fuel sulfur content of 1.5 percent. These factors were adjusted for the 15 ppmw sulfur content in ultra-low sulfur diesel fuel, by multiplying the emission factors by 0.001 and 0.86 for SO_2 and PM_{10}, respectively, following the approach used in Section 3.4.2 of the ICF Report.

/d Fuel consuption rate for Category 1 and 2 marine engines was estimated based on CO_2 emission factor (g/hp-hr) and the emission factor for the mass of CO_2 generated per gallon of fuel (10.21 kg CO_2/gal fuel) as presented in the Table 13.1 of the “2014 Climate Registry Default Emission Factors.” Fuel consumption for Category 3 marine engines was based on the BSFC (g/kW-hr) in the ICF International report.

Land-Based Stationary Diesel Engines, Excluding Fire Pumps (<= 2,237 kW and Displacement < 10 L/cylinder)

	Stationary Source Category	Engine Size (kW)	Subpart IIII standards (g/kWh) /a VOC	NO_x	CO	PM/ PM_{10}	(g/kWh) /b $PM_{2.5}$	Other Emission Factors (lb/MMBtu) /c, /d SO_2	CO_2	CH_4	N_2O	Fuel Cons. (gal/hp-hr) /e
200	Non-Emergency Engines (pre-2007)	kW < 8	1.3	9.2	8.0	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
201		8 <= kW < 19	1.18	8.32	6.6	0.80	0.78	0.0015	163.1	0.007	0.001	0.050
202		19 <= kW < 37	1.18	8.32	5.5	0.80	0.78	0.0015	163.1	0.007	0.001	0.050
203		37 <= kW < 56	1.3	9.2	11.4	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
204		56 <= kW < 75	1.3	9.2	11.4	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
205		75 <= kW < 130	1.3	9.2	11.4	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
206		130 <= kW < 225	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050
207		225 <= kW < 450	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050
208		450 <= kW < 560	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050
209		kW > 560	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050

/a Values are from Table 1 to 40 CFR 60 Subpart IIII, except as follows:
For highlighted cells, either a combined standard was provided (NMHC+NOx) or no standard was provided (CO and PM, and VOC in three cases).
Values for NMHC+NOx were apportioned into NOx and VOC rates based on the ratio of Tier 1 limits (9.2 g/kWh NOx and 1.3 g/kWh HC).
Substitute values for CO and PM (and VOC, when only a NOx standard was provided) were based on the worst-case rate provided for non-emergency pre-2007 engines.

/b All PM is assumed to less than 10 µm in diameter; therefore, PM emission factor is equivalent to PM_{10} emission factor. $PM_{2.5}$ is estimated to be 97 % of PM_{10} per EPA guidance in "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition," EPA420-R-10-018/NR-009d, July 2010.

/c SO2 emission factor based on typical mass balance for 0.0015% by weight ULSD, assuming 100% conversion of fuel sulfur to SO2.

/d Emission factors used to calculate emission rates for CO2 (73.96 kg/MMBtu), CH4 (0.003 kg/MMBtu) and N2O (0.0006 kg/MMBtu) were based on Tables C-1 and C-2 of 40 CFR Part 98 - Mandatory Greenhouse Gas Reporting, Subpart C - General Stationary Fuel Combustion Sources.

/e Fuel consumption rate is on a higher heating value (HHV) basis per unit of engine output, assuming the AP-42 specific consumption rate of 7,000 Btu/hp-hr, and a fuel heat content of 140,000 Btu/gal.

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EPA NEI HAP emission factors for Commercial Marine Vessels

HAP emission factors for commercial marine vessels were determined using the methodology identified by US EPA for the 2011 National Emissions Inventory (NEI); i.e., they are calculated as percentages of the PM10, PM2.5, or VOC emissions from the CMVs.

CMV fuel type			Diesel (distillate)		Residual			
Operating description			In Port	Underway	In Port		Underway	
SCC code			2280002100	2280002200	2280003100		2280003200	
Type			Maneuvering	Cruising	Manuevering	Hotelling	Cruising	Reduced Speed Zone
Type Code			M	C	M	H	C	Z
Pollutant	HAP?*	Fraction of						
Ammonia	No	PM10	0.01	0.02	0.00238	0.0108	0.00477	0.00477
Arsenic	Yes	PM10	0.0000175	0.00003	8.74126E-05	0.0004	0.000174825	0.000174825
Benzo[a]Pyrene	Yes	PM10	0.0000025	0.000005	4.37063E-07	0.000002	8.74126E-07	8.74126E-07
Benzo[b]Fluoranthene	Yes	PM10	0.000005	0.00001	8.74126E-07	0.000004	1.74825E-06	1.74825E-06
Benzo[k]Fluoranthene	Yes	PM10	0.0000025	0.000005	4.37063E-07	0.000002	8.74126E-07	8.74126E-07
Beryllium	Yes	PM10			0.000000546	0.000000546	0.000000546	0.000000546
Cadmium	Yes	PM10	0.00000283	0.00000515	0.0000226	0.0000059	0.0000226	0.0000226
Chromium (VI)	Yes	PM10	0.0000085	0.000017	0.00006528	0.000204	0.00006528	0.00006528
Chromium III	Yes	PM10	0.0000165	0.000033	0.00012672	0.000396	0.00012672	0.00012672
Cobalt	Yes	PM10			5.94406E-05	0.000292	0.000153846	0.000153846
Hexachlorobenzene	Yes	PM10	0.00000002	0.00000004	3.4965E-09	0.000000016	6.99301E-09	6.99301E-09
Indeno[1,2,3-c,d]Pyrene	Yes	PM10	0.000005	0.00001	8.74126E-07	0.000004	1.74825E-06	1.74825E-06
Lead	Yes	PM10	0.000075	0.00015	1.39642E-05	0.00006	0.0000262	0.0000262
Manganese	Yes	PM10	0.00000153	0.000001275	0.0000573	0.0000573	0.0000573	0.0000573
Mercury	Yes	PM10	0.000000025	0.00000005	2.7076E-07	0.0000014	5.24476E-07	5.24476E-07
Nickel	Yes	PM10	0.0005	0.001	0.003250219	0.0154	0.00589	0.00589
Phosphorus	Yes**	PM10			0.001787587	0.00438	0.005734266	0.005734266
Polychlorinated Biphenyls	Yes	PM10	0.00000025	0.0000005	4.37063E-08	0.0000002	8.74126E-08	8.74126E-08
Selenium	Yes	PM10	2.83E-08	5.15E-08	1.9125E-06	0.00000908	0.00000348	0.00000348
Total HAP (ratioed to PM10)			**0.0006**	**0.0013**	**0.0055**	**0.0212**	**0.0123**	**0.0123**
Acenaphthene	Yes	PM2.5	0.000018	0.000015	0.00000034	0.00000034	0.00000034	0.00000034
Acenaphthylene	Yes	PM2.5	0.00002775	0.000023125	0.000000525	0.000000525	0.000000525	0.000000525
Anthracene	Yes	PM2.5	0.00002775	0.000023125	0.000000525	0.000000525	0.000000525	0.000000525
Benz[a]Anthracene	Yes	PM2.5	0.00003	0.000025	0.000000567	0.000000567	0.000000567	0.000000567
Benzo[g,h,i,]Perylene	Yes	PM2.5	0.00000675	0.000005625	0.000000128	0.000000128	0.000000128	0.000000128
Chrysene	Yes	PM2.5	0.00000525	0.000004375	9.93E-08	9.93E-08	9.93E-08	9.93E-08
Fluoranthene	Yes	PM2.5	0.0000165	0.00001375	0.000000312	0.000000312	0.000000312	0.000000312
Fluorene	Yes	PM2.5	0.00003675	0.000030625	0.000000695	0.000000695	0.000000695	0.000000695
Naphthalene	Yes	PM2.5	0.00105075	0.000875625	0.0000199	0.0000199	0.0000199	0.0000199
Phenanthrene	Yes	PM2.5	0.000042	0.000035	0.000000794	0.000000794	0.000000794	0.000000794
Pyrene	Yes	PM2.5	0.00002925	0.000024375	0.000000553	0.000000553	0.000000553	0.000000553
Total HAP (ratioed to PM2.5)			**0.0013**	**0.0011**	**0.000024**	**0.000024**	**0.000024**	**0.000024**
2,2,4-Trimethylpentane	Yes	VOC	0.0003	0.00025	NA	NA	NA	NA
Acetaldehyde	Yes	VOC	0.0557235	0.04643625	0.000229	0.000229	0.000229	0.000229
Acrolein	Yes	VOC	0.002625	0.0021875	NA	NA	NA	NA
Benzene	Yes	VOC	0.015258	0.012715	0.0000098	0.0000098	0.0000098	0.0000098
Ethyl Benzene	Yes	VOC	0.0015	0.00125	NA	NA	NA	NA
Formaldehyde	Yes	VOC	0.1122	0.0935	0.00157	0.00157	0.00157	0.00157
Hexane	Yes	VOC	0.004125	0.0034375	NA	NA	NA	NA
Propionaldehyde	Yes	VOC	0.004575	0.0038125	NA	NA	NA	NA
Styrene	Yes	VOC	0.001575	0.0013125	NA	NA	NA	NA
Toluene	Yes	VOC	0.0024	0.002	NA	NA	NA	NA
Xylenes (Mixed Isomers)	Yes	VOC	0.0036	0.003	NA	NA	NA	NA
Total HAP (ratioed to VOC)			**0.2039**	**0.1699**	**0.0018**	**0.0018**	**0.0018**	**0.0018**

*For completeness, all of the pollutants in EPA's database are shown, but not all are HAP as defined in Section 112 of the Clean Air Act and as updated in 40 CFR 63 Subpart C.

**Only elemental phosphorus (CAS #7723140) is a HAP; phosphorus-containing compounds in general are not.

Reference: US EPA, "2011 National Emissions Inventory, version 1, Technical Support Document", draft, November 2013, available from http://www.epa.gov/ttn/chief/net/2011nei/2011_neiv1_tsd_draft.pdf; Table 104 on pp. 178-179 refers to the dataset "2011EPA_HAP-Augmentation" for HAP emissions, which is available from ftp://ftp.epa.gov/EmisInventory/2011/doc; the factors above are from that

OCEAN WIND OFFSHORE WIND FARM
HAP Emission Factor Calculation Sheet
Small Diesel Engines

Pollutant	Emission Factor (lb/MMBtu)[a]	Emission Factor Rating	Source (AP-42 Table)
Organic Compounds			
Benzene[b]	9.33E-04	E	3.3-2
Toluene[b]	4.09E-04	E	3.3-2
Xylene[b]	2.85E-04	E	3.3-2
1,3 Butadiene	< 3.91E-05	E	3.3-2
Propylene	2.58E-03	E	3.3-2
Formaldehyde[b]	1.18E-03	E	3.3-2
Acetaldehyde[b]	7.67E-04	E	3.3-2
Acrolein[b]	< 9.25E-05	E	3.3-2
PAH			
Naphthalene[b]	8.48E-05	E	3.3-2
Acenaphthylene[b]	< 5.06E-05	E	3.3-2
Acenaphthene[b]	< 1.42E-06	E	3.3-2
Fluorene[b]	2.92E-05	E	3.3-2
Phenanthrene[b]	2.94E-05	E	3.3-2
Anthracene[b]	1.87E-06	E	3.3-2
Fluoranthene[b]	7.61E-06	E	3.3-2
Pyrene[b]	4.78E-06	E	3.3-2
Benzo(a)anthracene[b]	1.68E-06	E	3.3-2
Chrysene[b]	3.53E-07	E	3.3-2
Benzo(b)fluoranthene[b]	< 9.91E-08	E	3.3-2
Benzo(k)fluoranthene[b]	< 1.55E-07	E	3.3-2
Benzo(a)pyrene[b]	< 1.88E-07	E	3.3-2
Indeno(1,2,3-cd)pyrene[b]	< 3.75E-07	E	3.3-2
Dibenz(a,h)anthracene[b]	< 5.83E-07	E	3.3-2
Benzo(g,h,i)perylene[b]	< 4.89E-07	E	3.3-2
TOTAL PAH	1.68E-04	E	3.3-2
Metals and inorganics[c]			
Arsenic[b]	4.62E-08		
Cadmium[b]	5.13E-09		
Chromium[b]	1.24E-05		
Chromium VI[b]	2.24E-06		
Lead[b]	7.69E-07		
Mercury[b]	1.03E-08		
Nickel[b]	1.48E-06		
Selenium[b]	2.56E-07		

Total for substances identified as HAP[e]	< 3.89E-03

[a] Values preceded by "<" are based on method detection limits.

[b] Specifically listed as a "Hazardous Air Pollutant" (HAP) in the Clean Air Act, or a component of Polycyclic Organic Matter, which is also listed as a HAP.

[c] Metal emissions are based on the paper *Survey of Ultra-Trace Metals in Gas Turbine Fuels,* 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detected in any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit is used.

[d] Hexavalent chrome was not detected in any fuel oil samples (in the note c reference study). However, to allow for potential hex chrome emissions formed during combustion, 18% of the total chrome emissions were assumed to be hex chrome (per EPA 453/R-98-004a)

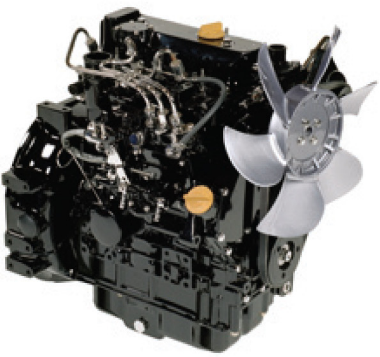
[e] Total calculated using the TOTAL PAH emission factor instead of factors for individual PAH.

Appendix B

FLiDAR Generator Vendor Data and Representative Vessel Information

YANMAR

2TNV70-HGE



Dimensions, Performance Data & Quick Specs

NET INTERMITTENT POWER (kW/hp) Potencia Neta Intermitente	13.4/10
RATED SPEED (RPM) Velocidad de Regimen	3600
LENGTH (in/mm) Longitud	16.4/417
WIDTH (in/mm) Ancho	16.1/410
HEIGHT (in/mm) Altura	19.8/504

SPECIFICATION Especificacion	HGE
CYLINDERS Cilindros	2
BORE X STROKE Diametro x Carrera	70 X 74 (mm) 2.75 X 2.91 (in)
DISPLACEMENT Cilindrada	570 (cc) 34.8(ci)

COMBUSTION TYPE
Tipo de Combustion

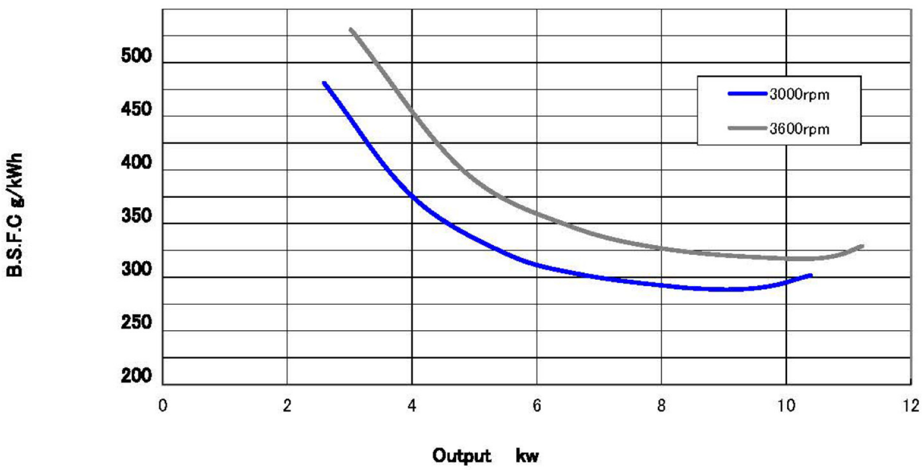
Indirect Injection
Inyección Indirecta

ASPIRATION
Aspiracion

Naturally Aspirated
Aspiracion Natural

GOVERNOR TYPE
Tipo de Gobernador

Mechanical
Mecánico



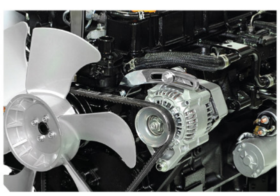
Lubrication System
2.2LL Capacity Deep Oil Pan

Electrical System
12V, 40A Alternator

Fuel System
In-line ML Fuel Injection Pump

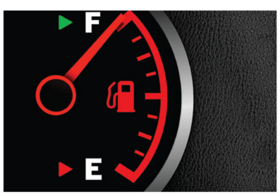
Cooling System
Water Pump, Belt-driven

Power Take Off
FWH: SAE #6 t=80
FW: SAE 6.5" CMP



Reliable and Durable
The TNV engines now proudly take up the running as Yanmar's premium small industrial diesel. They offer even more enhanced durability due to better block cooling, a stiffer crank and pistons, finer tolerance in the journal and more. CAE analysis has brought lower vibrations and higher strength to the mounting structure for even better reliability in heavy-duty jobs.

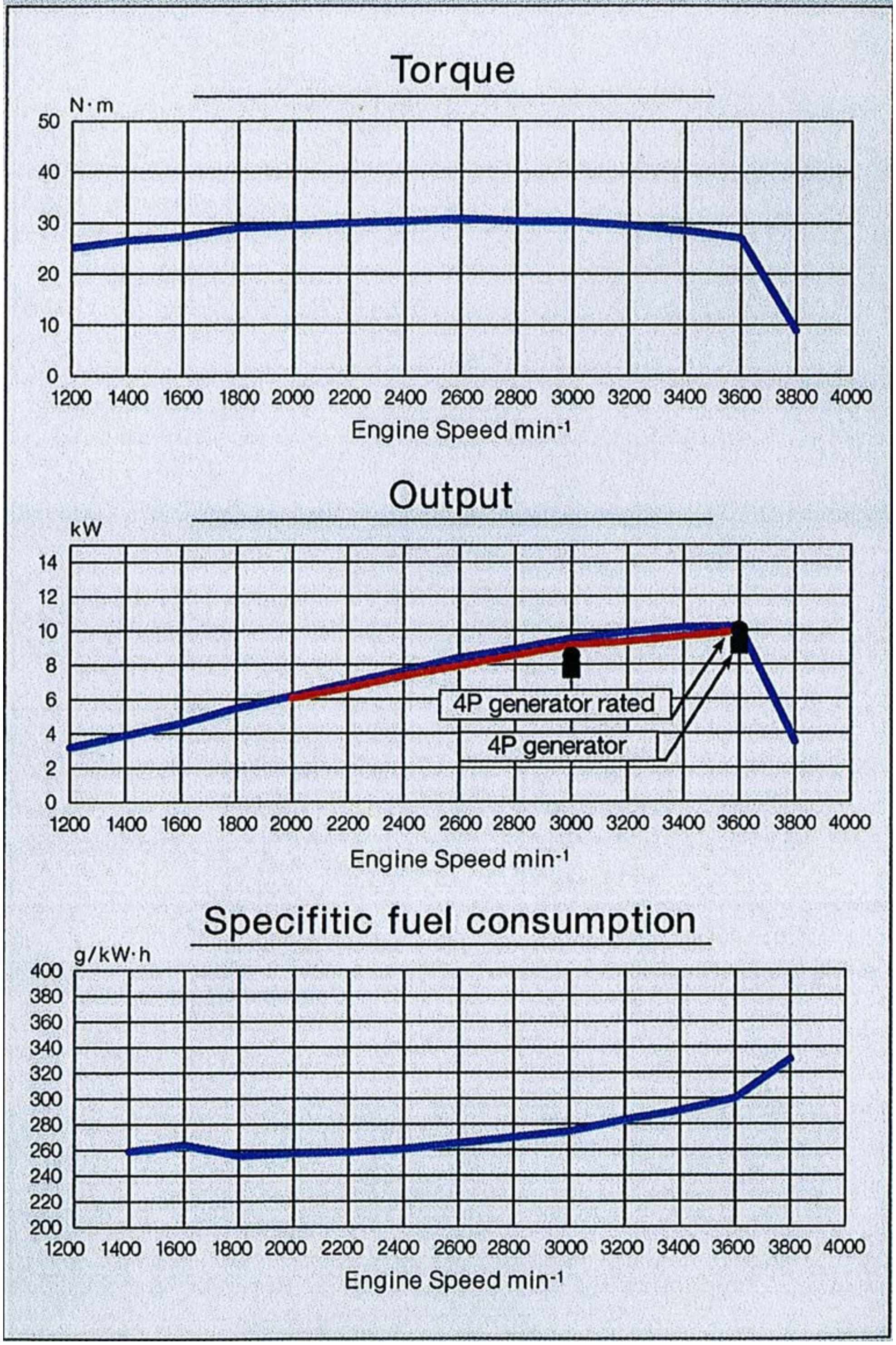
Clean Emissions
Building off the proven TNE design, Yanmar has achieved superior exhaust emissions by improving the combustion chamber and fuel injection equipment design. Engines are compliant with 2008 EPA Tier 4.



Fuel Delivery and Economy
A newly designed, in-line ML fuel injection pump is utilized to assure more precise fuel delivery and control. The result is reduced emissions, improved performance over a wide range of applications and increased fuel economy which assures that Yanmar's reputation for superior starting characteristics continues.

IE-3TNV88C-DYEM-SS0114

2TNV70



Note : Intermittant Rating

Red Line – Variable Speed
Blue Line – Fixed Speed

California Environmental Protection Agency AIR RESOURCES BOARD	YANMAR CO., LTD.	**EXECUTIVE ORDER U-R-028-0506** New Off-Road Compression-Ignition Engines

Pursuant to the authority vested in the Air Resources Board by Sections 43013, 43018, 43101, 43102, 43104 and 43105 of the Health and Safety Code; and

Pursuant to the authority vested in the undersigned by Sections 39515 and 39516 of the Health and Safety Code and Executive Order G-02-003;

IT IS ORDERED AND RESOLVED: That the following compression-ignition engines and emission control systems produced by the manufacturer are certified as described below for use in off-road equipment. Production engines shall be in all material respects the same as those for which certification is granted.

MODEL YEAR	ENGINE FAMILY	DISPLACEMENT (liters)	FUEL TYPE	USEFUL LIFE (hours)
2011	BYDXL0.57U2N	0.57	Diesel	3,000

SPECIAL FEATURES & EMISSION CONTROL SYSTEMS	TYPICAL EQUIPMENT APPLICATION
Indirect Diesel Injection	Generator Set

The engine models and codes are attached.

The following are the exhaust certification standards (STD) and certification levels (CERT) for hydrocarbon (HC), oxides of nitrogen (NOx), or non-methane hydrocarbon plus oxides of nitrogen (NMHC+NOx), carbon monoxide (CO), and particulate matter (PM) in grams per kilowatt-hour (g/kW-hr), and the opacity-of-smoke certification standards and certification levels in percent (%) during acceleration (Accel), lugging (Lug), and the peak value from either mode (Peak) for this engine family (Title 13, California Code of Regulations, (13 CCR) Section 2423):

RATED POWER CLASS	EMISSION STANDARD CATEGORY		EXHAUST (g/kW-hr)					OPACITY (%)		
			HC	NOx	NMHC+NOx	CO	PM	ACCEL	LUG	PEAK
8 ≤ kW < 19	Tier 4	STD	N/A	N/A	7.5	6.6	0.40	N/A	N/A	N/A
		CERT	--	--	6.0	1.3	0.15	--	--	--

BE IT FURTHER RESOLVED: That for the listed engine models, the manufacturer has submitted the information and materials to demonstrate certification compliance with 13 CCR Section 2424 (emission control labels), and 13 CCR Sections 2425 and 2426 (emission control system warranty).

Engines certified under this Executive Order must conform to all applicable California emission regulations.

This Executive Order is only granted to the engine family and model-year listed above. Engines in this family that are produced for any other model-year are not covered by this Executive Order.

Executed at El Monte, California on this 20 day of October 2010.

Annette Hebert

Annette Hebert, Chief
Mobile Source Operations Division

U-R-028-0506

9/30/10

Engine Model Summary Template

ATTACHMENT

Engine Family	1.Engine Code	2.Engine Model	3.BHP@RPM (SAE Gross)	4.Fuel Rate: mm/stroke @ peak HP (for diesel only)	5.Fuel Rate: (lbs/hr) @ peak HP (for diesels only)	6.Torque @ RPM (SEA Gross)	7.Fuel Rate: mm/stroke@peak torque	8.Fuel Rate: (lbs/hr)@peak torque	9.Emission Control Device Per SAE J1930
BYDXL0.57U2N	N/A	2TNV70-CHCL	15.2/3600	18.7	7.4	N/A	N/A	N/A	EM IFI
BYDXL0.57U2N	N/A	2TNV70-H	14.2/3600	17.5	6.9	N/A	N/A	N/A	EM IFI
BYDXL0.57U2N	N/A	2CA1-H	14.2/3600	17.5	6.9	N/A	N/A	N/A	EM IFI

NORTHSTAR COMMANDER

The Northstar Commander is a multi-purpose offshore utility vessel (work-boat), capable of performing a wide variety of duties such as towing, salvage, marine construction, oil-spill response work, in-shore supply work and supporting a wide array of scientific and research projects.

SPECIFICATIONS

Vessel Type	R/V / Commercial Utility Vessel
Length, overall	92ft
Beam	26ft
Draft	8.5ft
Engine	Twin screw Volvo D125-E 450hp each (new 2011)
Accommodations	12 births in 3 cabins
Navigation	2x Furuno Radars, Furuno Nav Net Chart Plotter, AIS & DGPS, Raytheon Thermal Imaging Camera
Fuel Capacity	10,000 gallons
Water Capacity	2,900 gallons with additional options available for extended cruises
Other Equipment	75 ton Tow Winch
	Generators: 1x 65KW John Deere (new 2015) 1X 65KW Caterpillar (reconditioned 2010)
	3.75 ton Palfinger PK 18080MD-S25 Marine Knuckleboom Crane
	Push Knee, Towing Winch, Capstan & Windlass
	Heavy A-frame ready, 16ft A-frame available
	Deck Office Container available
	Auxiliary Hydraulics and additional Pull Master Winches available
	Full USGS safety requirements met

(http://www.northstarmarineinc.com)

SPECIFICATIONS

Vessel Type	: Workboat
Documentation	: CG # 41406
Tonnage	: 28,500 lbs (Displ.)
Length, overall	: 41 ft
Beam	: 13 ft 5 in.
Draft	: 4 ft 1 in
Main Engines	: 2 x Cummins – 560 HP
Generator	: 24v – Battery System
Fuel capacity	: 480 g
Electronics	:Furuno Chart Plotter, VHF, Exceeds USCG Safety reqs.
Special features	:

Appendix C

Supplemental Tables of Equipment and Emissions in EPA-Requested Format

Table 1 – Ocean Wind Met Buoys Project – Equipment List

Equipment Make/Model	Year of Manufacture	Maximum Rated Power [BHP]	Operating Hours per Year	Fuel Type	Purpose/Function
Installation and Decommissioning Equipment					
Volvo D12D-G MH	2011	450	31.5	Marine diesel	Work vessel – marine propulsion engine
Volvo D12D-G MH	2011	450	31.5	Marine diesel	Work vessel – marine propulsion engine
John Deere 4045TF	2015	87	31.5	Marine diesel	Work vessel – auxiliary generator engine
Caterpillar / model unknown	2010	87	0	Marine diesel	Work vessel – auxiliary generator engine (backup)
Detroit 4-53 Series 53	Unknown	120	24	ULSD	Work vessel – deck engine for winch, crane, and A-frame
Volvo D9	2013	425	31.5	Marine diesel	Support vessel – marine propulsion engine
Volvo D9	2013	425	31.5	Marine diesel	Support vessel – marine propulsion engine
Operation and Maintenance Equipment					
1. One-Time Annual Inspection: One Recovery and One Re-Deployment					
Volvo D12D-G MH	2011	450	63	Marine diesel	Work vessel – marine propulsion engine
Volvo D12D-G MH	2011	450	63	Marine diesel	Work vessel – marine propulsion engine
John Deere 4045TF	2015	87	63	Marine diesel	Work vessel – auxiliary generator engine
Caterpillar / model unknown	2010	87	0	Marine diesel	Work vessel – auxiliary generator engine (backup)
Detroit 4-53 Series 53	Unknown	120	48	ULSD	Work vessel – deck engine for winch, crane, and A-frame
Volvo D9	2013	425	63	Marine diesel	Support vessel – marine propulsion engine
Volvo D9	2013	425	63	Marine diesel	Support vessel – marine propulsion engine
2. Quarterly Maintenance (Two Buoys)					
Volvo D9	2013	425	45	Marine diesel	Support vessel – marine propulsion engine
Volvo D9	2013	425	45	Marine diesel	Support vessel – marine propulsion engine
3. Operation (Two Buoys)					
Yanmar 2TNV70	2011	4.69 /a	500	ULSD	#1 FLIDAR Buoy – diesel generator engine
Yanmar 2TNV70	2011	4.69 /a	500	ULSD	#2 FLIDAR Buoy – diesel generator engine
/a As noted in the NOI, the Yanmar 2TNV70 engines will be derated from the manufacturer's original rated output of 13.4 hp (10 kW), to a lower output of 3.5 kW (4.7 hp). However, the manufacturer emission certificate is based on the original rated output.					

Table 2a – Ocean Wind Met Buoys Project – Applicable Emission Standards

Equipment Make/Model	NOx + THC (g/kWh)	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM/ PM10/ PM2.5 (g/kWh)	SO2 (fuel sulfur % wt.)	Basis/Reference
Volvo D12D-G MH	7.2	N/A	N/A	5.0	0.20	0.20	40 CFR 94.8 (2004 Category 1, Tier 2)
John Deere 4045TF	5.6	N/A	N/A	N/A	0.11	0.0015	40 CFR 1042 (2014-2017 Category 1, Tier 3)
Caterpillar / model unknown	7.2	N/A	N/A	5.0	0.20	0.20	40 CFR 94.8 (2004 Category 1, Tier 2)
Detroit 4-53 Series 53 /a	N/A	9.2	N/A	N/A	N/A	0.0015	40 CFR 60 Subpart IIII, Table 1 for 75 ≤ kW < 130 (100 ≤ hp < 175): NOx 40 CFR 60 Subpart IIII, §60.4207: Sulfur
Volvo D9	7.2	N/A	N/A	5.0	0.20	0.20	40 CFR 94.8 (2004 Category 1, Tier 2)
Yanmar 2TNV70/b (original rated output) (if considered emergency)	7.5	N/A	N/A	6.6	0.40	0.0015	40 CFR 60 Subpart IIII, Table 2 for 8 ≤ kW < 19 (11≤ hp < 25): NOx, VOC, CO, PM 40 CFR 60 Subpart IIII, §60.4207: Sulfur
Yanmar 2TNV70/b (derated output) (if considered emergency)	7.5	N/A	N/A	8.0	0.40	0.0015	40 CFR 60 Subpart IIII, Table 2 for kW < 8 (hp < 11): NOx, VOC, CO, PM 40 CFR 60 Subpart IIII, §60.4207: Sulfur
Yanmar 2TNV70 /b (original rated output) (if considered non-emergency)	7.5	N/A	N/A	6.6	0.80	0.0015	40 CFR 60 Subpart IIII, §60.4201 for 8 ≤ kW < 19 (11 ≤ hp < 25): NOx, VOC, CO, PM 40 CFR 60 Subpart IIII, §60.4207: Sulfur
Yanmar 2TNV70 /b (derated output) (if considered non-emergency)	7.5	N/A	N/A	8.0	0.80	0.0015	40 CFR 60 Subpart IIII, §60.4201 for kW < 8 (hp < 11): NOx, VOC, CO, PM 40 CFR 60 Subpart IIII, §60.4207: Sulfur

/a No standards for VOC, CO, or PM were provided in Subpart IIII for pre-2007 non-emergency engines in this size category.
/b As noted in the NOI, the Yanmar 2TNV70 engines will be derated from the manufacturer's original rated output of 13.4 hp (10 kW), to a lower output of 3.5 kW (4.7 hp). However, the manufacturer emission certificate for the engines is based on the Tier 4 limits for emergency engines, at the manufacturer's original rated output of 13.4 hp (10 kW), which placed them in the 8≤kW<19 size category. We acknowledge that the derated output for these engines falls in the next smaller size category (< 8 kW), but it is not clear that adding a mechanical limitation to prevent an engine from operating at its maximum output would qualify as a change to the "maximum engine power" as defined under 40 CFR 1039.

Note: To convert from g/kWh to g/HP-hr multiply by 0.746.

Table 2b – Ocean Wind Met Buoys Project – Emission Factors or Vendor Data Used to Calculate Potential Emissions

Equipment Make/Model	NOx + THC (g/kWh)	NOx (g/kWh)	VOC (g/kWh)	CO (g/kWh)	PM/ PM10/ PM2.5 (g/kWh)	SO2 (fuel sulfur % wt.)	Basis/Reference
Volvo D12D-G MH	N/A	9.8	0.27	5.0	0.26	0.0015	ICF International 2009, Tables 3-8, 3-9 /a
John Deere 4045TF	N/A	9.8	0.27	5.0	0.26	0.0015	
Caterpillar / model unknown	N/A	9.8	0.27	5.0	0.26	0.0015	
Detroit 4-53 Series 53 /b	N/A	9.2	1.3	11.4	1.0	0.0015	40 CFR 60 Subpart IIII, Table 1 for 75 ≤ kW < 130 (100 ≤ hp < 175): NOx 40 CFR 60 Subpart IIII, §60.4207: Sulfur
Volvo D9	N/A	9.8	0.27	5.0	0.26	0.0015	ICF International 2009, Tables 3-8, 3-9 /a
Yanmar 2TNV70 /c	6.0	5.3	0.7	1.3	0.15	0.0015	Manufacturer certificate: NOx, VOC, CO, PM 40 CFR 60 Subpart IIII, §60.4207: Sulfur

/a Potential emissions for marine engines are based on the worst-case values presented for Tier 1 and Tier 2 Category 1 engines in Table 3-8 of the April 2009 ICF International Report, "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories" (along with the correction factors for low-sulfur fuel provided in Table 3-9). The Tier 2 factors are based on the original 40 CFR 94 rulemaking in December 1999. The Tier 1 factors are conservatively based on the "baseline emission factors" for Category 1 marine engines as presented in Table 5-3 of the November 1999 EPA report, "Final Regulatory Impact Analysis: Control of Emissions from Marine Diesel Engines, EPA420-R-99-026." This conservative basis for estimating emissions in the NOI is intended to allow for the possibility that the exact vessels described in the NOI may not be available for use at the time actual project activities are conducted. The vessel specifications presented in the NOI are intended to be representative examples of the vessels that will be selected, but there is a possibility that the actual vessels selected to conduct installation, maintenance, or decommissioning activities for the Ocean Wind Met Buoy project may have slightly different engine specifications, or may be older vessels with engines manufactured prior to the applicability dates in 40 CFR 94 and/or 40 CFR 1042.

/b No standards for VOC, CO, or PM were provided in Subpart IIII for pre-2007 engines in this size category. Therefore, substitute values for VOC, CO, and PM were based on the worst-case rate provided for non-emergency pre-2007 engines in any size category.

/c Emissions for the Yanmar 2TNV70 engines are based on manufacturer certified rates. The certified NOx+THC emission rate was apportioned into NOx and VOC rates based on the ratio of Tier 1 limits (9.2 g/kWh NOx and 1.3 g/kWh HC).

Note: To convert from g/kWh to g/HP-hr multiply by 0.746.

Table 3 – Ocean Wind Met Buoys Project – Annual Emissions from Installation or Decommissioning of Buoy #1 (FLiDAR 1)

Equipment Make/Model	NOx (tpy)	CO (tpy)	VOC (tpy)	PM/ PM10/ PM2.5 (tpy)	SO2 (tpy)
Volvo D12D-G MH (Work vessel)	0.023	0.012	6.44E-04	6.16E-04	3.10E-06
Volvo D12D-G MH (Work vessel)	0.023	0.012	6.44E-04	6.16E-04	3.10E-06
John Deere 4045TF (Work vessel)	0.005	0.002	1.25E-04	1.19E-04	6.00E-07
Caterpillar / model unknown (Work vessel)	0	0	0	0	0
Detroit 4-53 Series 53 (Work vessel)	0.011	0.013	1.54E-03	1.18E-03	1.78E-06
Volvo D9 (Support vessel)	0.023	0.012	6.37E-04	6.09E-04	3.07E-06
Volvo D9 (Support vessel)	0.023	0.012	6.37E-04	6.09E-04	3.07E-06
Total Annual Emissions from Installation *or* Decommissioning for Buoy #1 /a	**0.108**	**0.063**	**4.23E-03**	**3.75E-03**	**1.47E-05**

/a The total tpy values in Table 3 represent the tons of emissions that would result from either the installation or decommissioning of Buoy # 1 (FLiDAR 1), which is the buoy located closer to the NJ shore. The tons of emissions from installation activities are equal to the tons of emissions from the decommissioning activities for Buoy #1. **For each buoy, the initial installation and final decommissioning will not occur in the same year.** However, to obtain the total combined tons of emissions resulting from the installation and decommissioning activities for FLiDAR 1, multiply the total tpy values in Table 3 by 2.

Table 3a – Ocean Wind Met Buoys Project – Annual Emissions from Installation or Decommissioning of Buoy #2 (FLiDAR 2)

Equipment Make/Model	NOx (tpy)	CO (tpy)	VOC (tpy)	PM/ PM10/ PM2.5 (tpy)	SO2 (tpy)
Volvo D12D-G MH (Work vessel)	0.026	0.013	7.09E-04	6.77E-04	3.41E-06
Volvo D12D-G MH (Work vessel)	0.026	0.013	7.09E-04	6.77E-04	3.41E-06
John Deere 4045TF (Work vessel)	0.005	0.003	1.37E-04	1.31E-04	6.60E-07
Caterpillar / model unknown (Work vessel)	0	0	0	0	0
Detroit 4-53 Series 53 (Work vessel)	0.011	0.013	1.54E-03	1.18E-03	1.78E-06
Volvo D9 (Support vessel)	0.025	0.013	7.01E-04	6.69E-04	3.37E-06
Volvo D9 (Support vessel)	0.025	0.013	7.01E-04	6.69E-04	3.37E-06
Total Annual Emissions from Installation OR Decommissioning for Buoy #2 /a	**0.118**	**0.068**	**4.50E-03**	**4.01E-03**	**1.60E-05**

/a Note: The Total tpy values in Table 3a represent the tons of emissions that would result from either the installation or decommissioning of Buoy # 2 (FLiDAR 2), which is the buoy located further from the NJ shore. The tons of emissions from installation activities are equal to the tons of emissions from the decommissioning activities for Buoy #2. **For each buoy, the initial installation and final decommissioning will not occur in the same year.** However, to obtain the total combined tons of emissions resulting from the installation and decommissioning activities for FLiDAR 2, multiply the Total tpy values in Table 3a by 2.

Table 4 – Ocean Wind Met Buoys Project – Annual Emissions from Operation and Maintenance: One-Time Annual Inspection: One Recovery and One Re-Deployment, combined, from Buoy #1 (FLiDAR 1)

Equipment Make/Model	NOx (tpy)	CO (tpy)	VOC (tpy)	PM/ PM10/ PM2.5 (tpy)	SO2 (tpy)
Operation and Maintenance					
1.a One-Time Annual Inspection: One Recovery OR One Re-Deployment for Buoy #1 (FLiDAR 1)					
Volvo D12D-G MH (Work vessel)	0.023	0.012	6.44E-04	6.16E-04	3.10E-06
Volvo D12D-G MH (Work vessel)	0.023	0.012	6.44E-04	6.16E-04	3.10E-06
John Deere 4045TF (Work vessel)	0.005	0.002	1.25E-04	1.19E-04	6.00E-07
Caterpillar / model unknown (Work vessel)	0	0	0	0	0
Detroit 4-53 Series 53 (Work vessel)	0.011	0.013	1.54E-03	1.18E-03	1.78E-06
Volvo D9 (Support vessel)	0.023	0.012	6.37E-04	6.09E-04	3.07E-06
Volvo D9 (Support vessel)	0.023	0.012	6.37E-04	6.09E-04	3.07E-06
Total Annual Emissions for One-Time Annual Inspection from One Recovery OR One Re-Deployment for Buoy #1 /a	**0.108**	**0.063**	**4.23E-03**	**3.75E-03**	**1.47E-05**
Total Annual Emissions for One-Time Annual Inspection from One Recovery AND One Re-Deployment, combined, for Buoy #1 /b	**0.217**	**0.127**	**8.43E-03**	**7.50E-03**	**2.94E-05**

/a The total tpy values in Table 4 represent the tons of emissions that would result from the one-time annual inspection activities for **either** the recovery **or** the re-deployment of Buoy # 1 (FLiDAR 1), which is located closer to the NJ shore; the tons of emissions from the recovery are equal to the tons of emissions from the re-deployment activities for Buoy #1. The recovery and re-deployment activities for Buoy #1 during the one-time annual inspection will occur in the same year.

/b Total annual emissions from the one-time annual inspection from one recovery **AND** one re-deployment, combined, for Buoy #1 are equal to **[total annual emissions from one recovery OR one re-deployment for Buoy #1] x [2]**

Table 4a – Ocean Wind Met Buoys Project – Annual Emissions from Operation and Maintenance: One-Time Annual Inspection: One Recovery and One Re-Deployment, combined, from Buoy #2 (FLiDAR 2)

Equipment Make/Model	NOx (tpy)	CO (tpy)	VOC (tpy)	PM/ PM10/ PM2.5 (tpy)	SO2 (tpy)
Operation and Maintenance					
1.b. One-Time Annual Inspection: One Recovery OR One Re-Deployment for Buoy #2 (FLiDAR 2)					
Volvo D12D-G MH (Work vessel)	0.026	0.013	7.09E-04	6.77E-04	3.41E-06
Volvo D12D-G MH (Work vessel)	0.026	0.013	7.09E-04	6.77E-04	3.41E-06
John Deere 4045TF (Work vessel)	0.005	0.003	1.37E-04	1.31E-04	6.60E-07
Caterpillar / model unknown (Work vessel)	0	0	0	0	0
Detroit 4-53 Series 53 (Work vessel)	0.011	0.013	1.54E-03	1.18E-03	1.78E-06
Volvo D9 (Support vessel)	0.025	0.013	7.01E-04	6.69E-04	3.37E-06
Volvo D9 (Support vessel)	0.025	0.013	7.01E-04	6.69E-04	3.37E-06
Total Annual Emissions for One-Time Annual Inspection from One Recovery OR One Re-Deployment for Buoy #2 /a	**0.118**	**0.068**	**4.50E-03**	**4.01E-03**	**1.60E-05**
Total Annual Emissions for One-Time Annual Inspection from One Recovery AND One Re-Deployment, combined, for Buoy #2 /b	**0.236**	**0.136**	**8.99E-03**	**8.02E-03**	**3.20E-03**

/a The total tpy values in Table 4a represent the tons of emissions that would result from the one-time annual inspection activities for **either** the recovery **or** the re-deployment of Buoy # 2 (FLiDAR 2), which is located further from the NJ shore; the tons of emissions from the recovery are equal to the tons of emissions from the re-deployment activities for Buoy #2. The recovery and re-deployment activities for Buoy #2 during the one-time annual inspection will occur in the same year.

/b Total annual emissions from the one-time annual inspection from one recovery **AND** one re-deployment, combined, for Buoy #2 are equal to **[total annual emissions from one recovery OR one re-deployment for Buoy #2] x [2]**

Table 4b – Ocean Wind Met Buoys Project – Annual Emissions from Operation and Maintenance

Equipment Make/Model	NOx (tpy)	CO (tpy)	VOC (tpy)	PM/ PM10/ PM2.5 (tpy)	SO2 (tpy)
Operation and Maintenance					
2. Quarterly Maintenance Activities (for Buoy #1 and Buoy #2, combined)					
Volvo D9 (Support vessel)	0.069	0.035	1.91E-03	1.83E-03	9.20E-06
Volvo D9 (Support vessel)	0.069	0.035	1.91E-03	1.83E-03	9.20E-06
Total Annual Emissions from Quarterly Maintenance Activities for Buoy #1 and Buoy #2, combined [Assuming 3 maintenance events/yr]	**0.139**	**0.071**	**3.82E-03**	**3.65E-03**	**1.84E-05**
3. Operation (Buoy #1 and Buoy #2, combined)					
Yanmar 2TNV70 (FLIDAR 1)	0.010	0.003	1.42E-03	2.89E-04	1.74E-05
Yanmar 2TNV70 (FLIDAR 2)	0.010	0.003	1.42E-03	2.89E-04	1.74E-05
Total Annual Emissions from Operation of Buoy #1 and Buoy #2, combined	**0.036**	**0.009**	**5.17E-03**	**1.04E-03**	**3.47E-05**
	NOx (tpy)	**CO (tpy)**	**VOC (tpy)**	**PM/ PM10/ PM2.5 (tpy)**	**SO2 (tpy)**
Total Annual Emissions from Operation and Maintenance of Buoy #1 and Buoy #2, combined /a	**0.159**	**0.076**	**6.67E-03**	**4.23E-03**	**5.31E-05**

/a Total annual emissions from the operation and maintenance of Buoy #1 and Buoy #2, combined in Table 4b is the sum of the following:

[total one-time annual inspection emissions from one recovery and one re-deployment, combined, for Buoy #1] +
[total one-time annual inspection emissions from one recovery and one re-deployment, combined, for Buoy #2] +
[total annual emissions from quarterly maintenance activities for Buoy #1 and Buoy #2, combined] +
[total annual emissions from operation of Buoy #1 and Buoy #2, combined].

Table 4c – Ocean Wind Met Buoys Project – TOTAL Annual Emissions from the Installation, Operation, and Maintenance Activities of Both Buoys Combined, OR from the Decommissioning, Operation and, Maintenance Activities of Both Buoys Combined

	NOx (tpy)	CO (tpy)	VOC (tpy)	PM/ PM10/ PM2.5 (tpy)	SO2 (tpy)
TOTAL Annual Emissions from the Installation, Operation, and Maintenance Activities of Both Buoys Combined, OR Total Annual Emissions from the Decommissioning, Operation, and Maintenance Activities of Both Buoys Combined /a	**0.84**	**0.47**	**0.033**	**0.028**	**1.80E-04**

/a Total annual emissions from the installation, operation, and maintenance activities for both buoys combined, OR from the decommissioning, operation, and maintenance activities for both buoys combined, is the sum of the following:

[total annual emissions from installation of Buoy #1] +
[total annual emissions from installation of Buoy #2] +
[total one-time annual inspection emissions from one recovery and one re-deployment, combined, for Buoy #1] +
[total one-time annual inspection emissions from one recovery and one re-deployment, combined, for Buoy #2] +
[total annual emissions from quarterly maintenance activities for Buoy #1 and Buoy #2, combined] +
[total annual emissions from operation of Buoy #1 and Buoy #2, combined].

OR

[total annual emissions from decommissioning of Buoy #1] +
[total annual emissions from decommissioning of Buoy #2] +
[total one-time annual inspection emissions from one recovery and one re-deployment, combined, for Buoy #1] +
[total one-time annual inspection emissions from one recovery and one re-deployment, combined, for Buoy #2] +
[total annual emissions from quarterly maintenance Activities for Buoy #1 and Buoy #2, combined] +
[total annual emissions from operation of Buoy #1 and Buoy #2, combined].

The tons of emissions from the installation are equal to the tons of emissions from the decommissioning activities of Buoy # 1 or #2; the installation and decommission of either buoy will not occur in the same year.

Appendix D

Letters from Proposed Work Boat Operator Regarding Dynamic Positioning and Battery-Power Capabilities

NORTHSTAR
ENVIRONMENTAL & MARINE SERVICES
Est. 1990

36 Clermont Dr.
Clermont, NJ 08210

609-263-6666
609-624-1055 Fax

www.northstarmarineinc.com

3rd March, 2018

Dear Mr. Cross:

As requested by U.S. EPA Region 2, this letter serves to confirm that our multi-purpose offshore utility vessel, the Northstar Commander, can be and has been maintained during various offshore construction activities, similar in nature with the installation and decommissioning activities of the met buoys for your proposed Ocean Wind project, in a fixed location only using the work vessel's engines (i.e., propulsion and auxiliary) and without requiring any attachment of the work vessel to the seabed.

Please contact me at (609) 263-6666 if you require any further information or assistance.

Sincerely,

David C.I. Morgan
VP - Marine Operations
Northstar Marine Inc.

NORTHSTAR

ENVIRONMENTAL & MARINE SERVICES
Est. 1990

36 Clermont Dr.
Clermont, NJ 08210

609-263-6666
609-624-1055 Fax

www.northstarmarineinc.com

April 4th, 2018

Mr. Marcus Cross
Senior Project Lead
Ocean Wind LLC
One International Place, Suite 2610
Boston, MA 02114

Subject: Battery Operation Capabilities of the Northstar Enterprise

Dear Mr. Cross:

As requested by U.S. EPA Region 2, this letter serves to confirm that our 41 ft. workboat vessel, the Northstar Enterprise, is capable of shutting off its main engines and operating only on battery power while tied up or moored to an offshore buoy during maintenance visits.

Please contact me at (609) 263-6666 if you require any further information or assistance.

Sincerely,

David C.I. Morgan
VP - Marine Operations
Northstar Marine Inc.

Application Additional Information

Petriman, Viorica

From: Marcus Cross <MARCR@orsted.com>
Sent: Friday, May 11, 2018 11:07 AM
To: Petriman, Viorica
Cc: Charles R. Scott; Ørsted OCW01 - Permitting; Chan, Suilin; Froikin, Sara; Ruvo, Richard; Fontaine, Peter
Subject: RE: Ocean Wind OCS Air Permit Application
Attachments: 170601 Notice OCW01-001.pdf

Dear Ms Petriman

Please find additional information below that believe meets your expections.

Best regards,
Marcus Cross
Senior Project Lead
Project Development US
Wind Power

Ørsted
Tel. +1(857)310-8232

From: Petriman, Viorica [mailto:Petriman.Viorica@epa.gov]
Sent: Friday, May 4, 2018 2:55 PM
To: Marcus Cross <MARCR@orsted.com>
Cc: Charles R. Scott <CHSCO@orsted.com>; Ørsted OCW01 - Permitting <OCW01-Permitting@orsted.com>; Chan, Suilin <Chan.Suilin@epa.gov>; Froikin, Sara <Froikin.Sara@epa.gov>; Ruvo, Richard <Ruvo.Richard@epa.gov>
Subject: Ocean Wind OCS Air Permit Application

Dear Mr. Cross,

I am writing to follow up on a number of items from the recent Ocean Wind permit application you submitted. If you would like, it may be useful for us to have a quick call to walk through these items and answer any questions.

Coastal Zone Management Act (CZMA) and National Historic Preservation Act (NHPA)

During conversations earlier this year, and via email on March 8, we had asked that the Ocean Wind permit application address the CZMA and NHPA. However, the permit application you submitted contains no substantive discussion of these acts beyond brief references in Table 6. As a courtesy to Ocean Wind, though, and in order to expedite the permitting process at this point, EPA will instead review and rely on the relevant CZMA and NHPA sections of BOEM's "January 2012 Final Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia" in lieu of the omitted discussion in Ocean Wind's application. We have also obtained some other supporting documentation from BOEM regarding CZMA and NHPA which we may rely upon in our review, and which will be included in the permitting record for Ocean Wind draft permit. If you would like, we would be happy to provide you with copies of those documents. If you are aware of any other supporting documents relevant to CZMA and NHPA that you think would assist us in reviewing your permit application and would like to include them in the permitting record, please provide them.

We understand that there is no action necessary for Ocean Wind to address and we respectfully request that the EPA provides us with copies of the referenced documents

Environmental Justice/Public Outreach

The "Public Outreach" section of Ocean Wind's permit application (section 5.1.9, page 22) states that Ocean Wind's Fisheries Liaison Officer "has been actively engaging with the commercial and recreational fishing industry." Would it be possible to provide 1) documentation (i.e., meeting agendas, meeting minutes, etc.,) regarding the public outreach or engagement that Ocean Wind's Fisheries Liaison Officer has done so far with the commercial and recreational fishing industry in New Jersey, and 2) a description of the public outreach that Ocean Wind plans to conduct (through their Fisheries Liaison Officer or by other means) prior to the met buoys deployment and throughout the met buoys operation. We note that we asked for such documentation in conversations and via e-mail dated Feb. 6, 2018, and we plan to rely on it as part of the permitting record.

30 CFR 585.605 requires Ocean Wind to describe the activities we plan to perform to characterize the met-ocean resources within our commercial lease within an Site Assessment Plan (SAP). Our SAP must include data on the geophysical, archeological and environmental resources. The SAP must be approved by BOEM prior to the deployment of the met-ocean devices. To support the SAP, and where appropriate in accordance with our lease (OCS-A 0498), Ocean Wind has reached out to the fishing and tribal communities.

There are no specific stipulations concerning interactions with commercial and recreational fishing are provided in our Lease, however as recommended in BOEM's October 20, 2015 Fisheries Social and Economic Conditions guidance document (BOEM 2015), Ocean Wind LLC have committed to develop a Fisheries Communication Plan and hired a Fisheries Liaison Officer (FLO), Mr. John Williamson, and employed Fisheries Industry Representative (FIR), who was on board the HRG survey vessel during the geophysical survey activities that characterized the location where we propose to deploy the metocean devices. Between May and August 2017 the FLO and FIR conducted outreach with the local fishing community which involved the distribution of a 'Notice to fisherman' (attached) as well as one-to-one meeting, emails and phone calls. Within our SAP we have committed to continue outreach with commercial and recreational fishermen that will be developed once approved. In addition, Ocean Wind will notify commercial and recreational fishermen, as well as other users of the area about the proposed activities via a LNM and broadcasts on Marine Channel 16 prior to installation and decommissioning of the met-buoy. Ocean Wind will also submit an application to the USCG for a PATON for the Met Buoys.

In addition, stipulation 4.3.3 of our Lease (OCS_A 0498) requires Ocean Wind to invite the Narragansett Indian Tribe, the Shinnecock Indian Nation and the Lenape Tribe of Delaware to a tribal pre-survey meeting. All three tribes were invited by certified mail with only the Lenape Tribe of Delaware requesting a meeting. Ocean Wind, supported by a Qualified Marine Archeologist (QMA), attended a Tribal pre-survey meeting with the Lenape Tribe of Delaware on May 3, 2017 in Dover, Delaware. During this meeting, Ocean Wind, Tetra Tech, RCG&A (QMA), and the Lenape Tribe of Delaware discussed the geophysical survey plan and any issues related to submerged archaeological resources that may require evaluation during the survey and the proposed buoy deployments.

We hope that Ocean Wind will be able to quickly help us supplement the information before us as part of this permitting action, so that we can continue to make progress on this matter.

Thank you,

Viorica Petriman
Environmental Engineer
US EPA–Region 2
Air Programs Branch
Air Permitting Section
212-637-4021

Notice OCW01-001 June 1, 2017

NOTICE TO FISHERMEN

Geophysical Survey to start mid-June 2017
Estimated duration 24 days
(weather permitting)

OCEAN WIND
A DONG Energy Initiative

RV Ocean Researcher

230 ft. Flag: United Kingdom

Bridge VSAT phone: 011 44 1493 236011

Vessel email: master@researcher.gardline.co.uk

Standing by on VHF channel 16

Site Assessment and Geophysical Survey of the New Jersey Ocean Wind area

For the next three years DONG Energy US Wind Power will be collecting data on the physical, biological and economic characteristics of BOEM lease area OCS-A0498 east of Sea Isle City, NJ to assess suitability for the construction of an offshore wind farm. As the first step of data collection DONG Energy will conduct a site assessment and geophysical survey in June/July 2017. A local fisherman will serve as the onboard fisheries point of contact, advising the vessel master to avoid gear conflicts.

Fishermen working in the Survey Area with questions are requested to call:

Art Unkefer, cell: 609 816-0291

Fishing Industry Representative aboard RV Ocean Researcher

Bridge VSAT phone or VHF channel 16

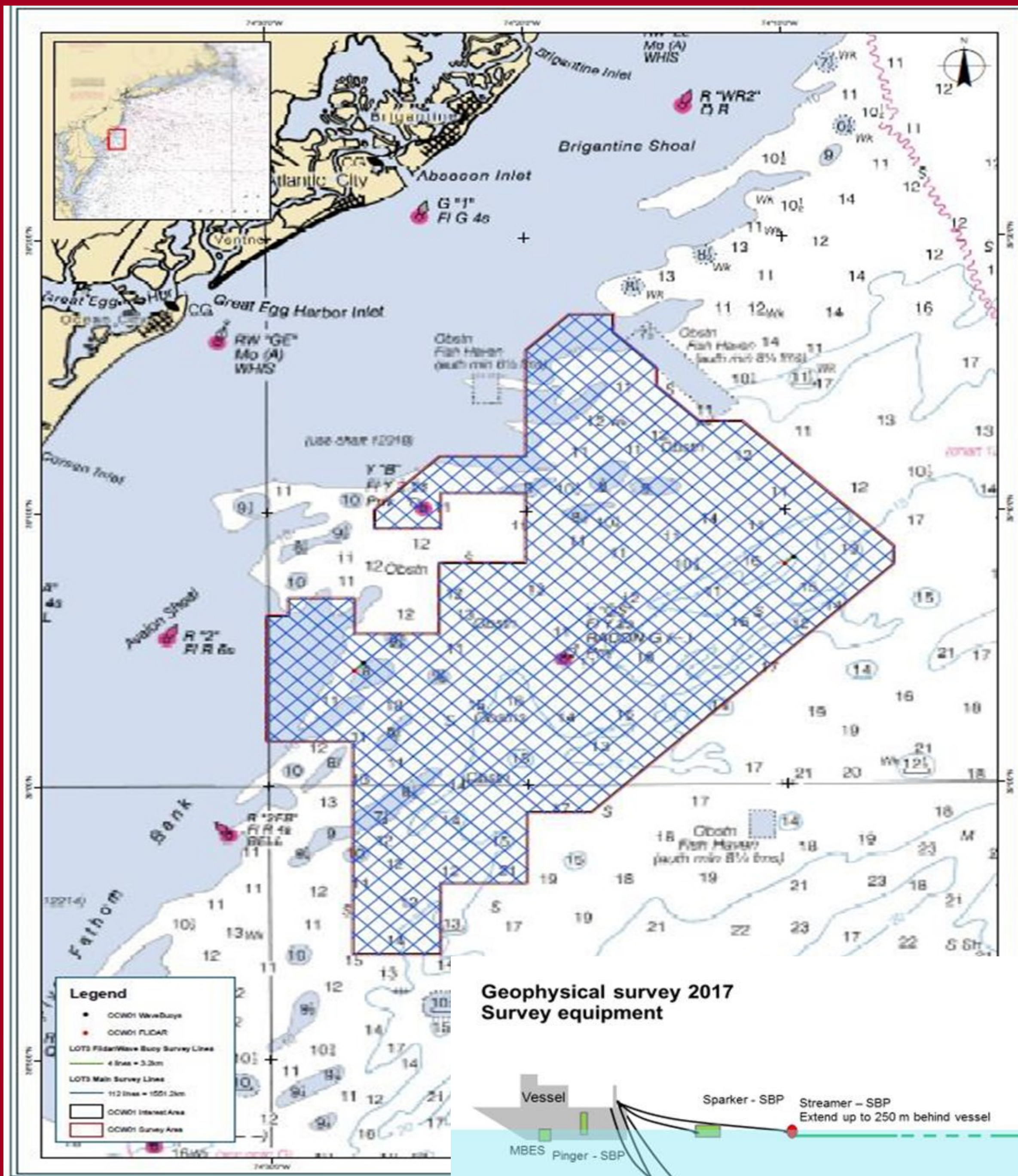
In advance of operations, please contact:

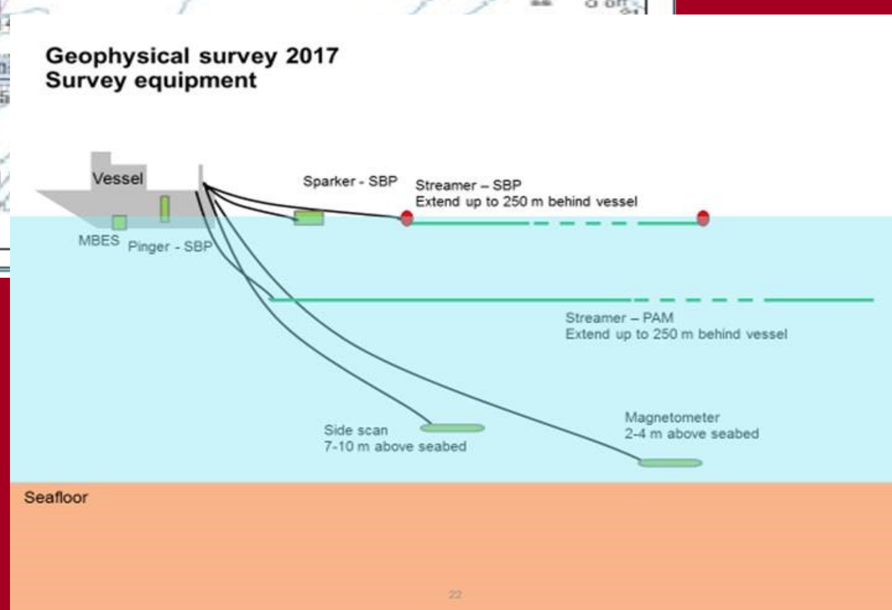
John Williamson, DONG Energy Fishery Liaison

Cell: 207 939-7055 **john@seakeeper.net**

DONG energy

Please add your contact information to our file of fishermen in the lease area. Fishermen's information is respected as confidential.





The survey vessel will make straight transects across the Survey Area in grids, running both NW-SE and NE-SW, spaced about a half-mile apart.

Grab samples of seabed will be taken at select locations, each sample about 1/10th cubic yard.

DONG energy

The survey vessel will tow sensors through the water column (above the sea bed). The sensors will include multi-beam and side scan sonars, magnetometer, high and medium frequency sub-bottom profilers.

Petriman, Viorica

From: Petriman, Viorica
Sent: Friday, May 18, 2018 11:18 AM
To: 'Marcus Cross'
Cc: Froikin, Sara
Subject: Ocean Wind Application
Attachments: Appendix B (Ocean Wind -Met Buoys Engines).pdf

Dear Mr. Cross,

In the Ocean Wind application the met buoys diesel-fueled engines are described as Yanmar 2TNV70 engines, rated at

10 kilowatts (**13.4 horsepower**), and indicates that the engines will be derated to 3.5 kW (4.5 BHP).

However, in the engine's information from Yanmar, which are included in Appendix B of the application (see attached), the engines are described as 2TNV70 Yanmar engines, rated at **13.4 kilowatts** (**10 horsepower)**.

Would it be possible to clarify this inconsistency?

Also, could you please provide information on the type of exhaust/stack heights for the auxiliary engines of the workboat vessel and the Detroit diesel engine onboard the workboat vessel.

Thank you,

Viorica Petriman
Environmental Engineer
US EPA–Region 2
Air Programs Branch
Air Permitting Section
212-637-4021

Memo

Subject	Met-buoy Air Permit Application	
To	Viorica Petriman	
Copy	Sara Ayres, Melanie King, Suilin Chan, Sara Froikin, Dan Ryan, Peter Fontaine, Julian Ralf Jensen, Elizabeth-Anne Treseder, Laura Sliker	
From	Marcus Cross	
Regarding	Response to questions from the EPA Region 2 on Ocean Wind Air Permit application for the deployment of met-buoys	21 May 2018

Dear Ms Petriman

Please find below feedback on the questions raised on the 17th and 18th May 2018

Question 1:

As we have been reviewing the Ocean Wind permit application, a question has been raised in conversations with our headquarters regarding the application's discussion of derating the met buoys' diesel generator engines (see, e.g., pages 5 & 13

Response 1:

Based on the power requirement needs of the FLiDAR system, we stated to the manufacturer that we would only be needing in the neighbourhood of 3kW (105A @28V) of power. The manufacturer recommended a custom alternator winding solution for running at a lower engine speed (~1800 RPM), allowing better electrical efficiency at that speed. This also has the additional benefits of improved fuel economy and less wear on critical engine parts. Emission levels for the Yanmar engine are detailed in Appendix B of our application and confirmed in an Executive Order signed by the California EPA Air Resources Board. I believe that the emission values presented in our application are based on the original rated power. The engine itself has not been altered it is capable of 10kW at 3600 RPM, with the electric generator pulling out 6kW max.

Question 2:

*In the Ocean Wind application the met buoys diesel-fueled engines are described as Yanmar 2TNV70 engines, rated at **10 kilowatts** (**13.4 horsepowe**r), and indicates that the engines will be derated to 3.5 kW (4.5 BHP). However, in the engine's information from Yanmar, which are included in Appendix B of the application (see attached), the engines are described as 2TNV70 Yanmar engines, rated at **13.4 kilowatts** (**10 horsepower)**. Would it be possible to clarify this inconsistency?*

Response 2:

The Yanmar data sheet has the kW and hp labels reversed. The correct (original) rating should be 10 kW, equal to 13.4 hp and this is what was used in our emission calculations

To demonstrate the Yanmar sheet mixed up the labels using the conversion between kW and hp:

- To convert hp to kW, multiply by 0.746
- To convert kW to hp, divide by 0.746

Applying these conversions to the Yanmar data sheet would produce incorrect values:

- 13.4 kW / (0.746) = 18.0 hp
- 10 hp * (0.746) = 7.46 kW

But if we switch the labels on the Yanmar sheet we get the correct results:

- 13.4 hp * (0.746) = 10.0 kW
- 10 kW / (0.746) = 13.4 hp

Question 3:
Could you please provide information on the type of exhaust/stack heights for the auxiliary engines of the workboat vessel and the Detroit diesel engine onboard the workboat vessel.

Response 3:
We have reached out to the vessel operator for this information.

Petriman, Viorica

From: Marcus Cross <MARCR@orsted.com>
Sent: Friday, July 6, 2018 11:24 AM
To: Petriman, Viorica
Cc: Ørsted OCW01 - Permitting
Subject: RE: Ocean Wind Met Buoys Project

Hi Viorica

I hope you enjoyed some time off with the family on the 4th?

In response to the Northstar Commander workboat exhaust queries:

- Two dry exhaust Volvo main diesel engines with stacks approximately 18 feet off the deck.
- Two main generators on board, one is a Caterpillar and the other is a John Deere. Both are dry exhaust and come out the same stacks as the main engines
- The Detroit engine has it's own exhaust stack approx. 18feet of the deck (same location as above)

Best regards,
Marcus Cross
Senior Project Lead
Project Development US
Wind Power

Ørsted
Tel. +1(857)310-8232

From: Petriman, Viorica [mailto:Petriman.Viorica@epa.gov]
Sent: Monday, July 2, 2018 11:27 AM
To: Marcus Cross <MARCR@orsted.com>
Subject: RE: Ocean Wind Met Buoys Project

Marcus,

Thank you very much for the e-mail/clarification that we can proceed with the our review of the 4/26/2018. We plan to send you an application completeness letter soon.

There was a question which was not addressed in your 5/21/2018 submittal (see attached). It's regarding the type of exhaust/stack heights for the auxiliary engines of the workboat and the Detroit diesel engine onboard the workboat vessel. Have you got the answers from the workboat vessel?

Viorica Petriman
Environmental Engineer
US EPA–Region 2
Air Programs Branch
Air Permitting Section
212-637-4021

Question 3:

Could you please provide information on the type of exhaust/stack heights for the auxiliary engines of the workboat vessel and the Detroit diesel engine onboard the workboat vessel.

Response 3:

We have reached out to the vessel operator for this information.

From: Marcus Cross [mailto:MARCR@orsted.com]
Sent: Monday, July 2, 2018 10:38 AM
To: Petriman, Viorica <Petriman.Viorica@epa.gov>
Cc: Froikin, Sara <Froikin.Sara@epa.gov>; Villatora, Liliana <Villatora.Liliana@epa.gov>; Ruvo, Richard <Ruvo.Richard@epa.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Ørsted OCW01 - Permitting <OCW01-Permitting@orsted.com>
Subject: RE: Ocean Wind Met Buoys Project

Dear Viorica

Thank you for the call and information on Friday it was very useful and helpful

As discussed I've had a look at the air permit application that we submitted and believe it adequately describes our proposed activities. Where their maybe actual differences in the final activities these will not exceed what has been described e.g we may decommission prior sooner than 2yrs. We therefore do not propose to submit a modified application and request that the EPA continues to proceeds with the authorization process.

Furthermore, we understand that you do not recognize that using alternator winding for running the engine at a lower speed constitutes de-rating and therefore the air permit will be based on a 10kw engine

If you have any further queries please let me know and any updates on the process of our application would be appreciated.

Best regards,
Marcus Cross
Senior Project Lead
Project Development US
Wind Power

Ørsted
Tel. +1(857)310-8232