Attachment 1:
Table of Attachments

TABLE OF ATTACHMENTS

Unless indicated with an asterisk, all documents are excerpts from the Administrative Record. Docket locations and file names indicate where, and under what name, the documents can be found in the Regulations.gov docket, docket number EPA-R02-OAR-2024-0312.

Attachment 2: Letter from Suilin Chan to Kyle Hilberg dated August 21, 2023 finding the OCS Air Permit Application for Atlantic Shores Project 1 and Project 2 complete (Document 2.3 in the Docket, entitled "2.3 8-21-2023 EPA Completeness Determination on Atlantic Shores South"). Attachment includes full document.

Attachment 3: Final Permit Application submitted by Atlantic Shores Offshore Wind Project 1, LLC on June 28, 2024 (Document 2.1.1 in the Docket, entitled "2.1.1 ASOW_OCS Air Application - 2024-06-26_r"). Attachment contains document excerpts.

Attachment 4: Fact Sheet Accompanying Draft Permit (Document 1.3 in the Docket, entitled "1.3 Atlantic Shores OCS Fact Sheet July 11 2024"). Attachment contains document excerpts.

Attachment 5: Draft Permit Issued July 11, 2024 (Document 1.1 in the Docket, entitled "1.1 Atlantic Shores Draft OCS Permit July 11 2024"). Attachment contains document cover.

Attachment 6: Response to Comments Accompanying Final Permit (Document A.3 in the Docket entitled "A.3 ASOW EPA Response to Comments Sept. 29 2024r"). Attachment contains document excerpts.

Attachment 7*: September 30, 2024 Email from Suilin Chan to Jennifer Daniels Issuing Permit (Not in docket). Attachment includes full document.

Attachment 8: Final Permit Issued September 30, 2024 (Document A.2 in the Docket entitled "A.2 ASOW Final OCS Permit Sept. 29 2024r"). Attachment contains document excerpts.

Attachment 9*: September 30, 2024 Email from Maya Greally to Commenters (Not in docket). Attachment includes full document.

Attachment 10: September 11, 2023 Letter from Kyle Hilberg to Suilin Chan (Document 3.4.2 in the Docket entitled "3.4.2 Atlantic Shores Responses 9-11-2023"). Attachment includes full document.

Attachment 11: Supplemental Information Provided by Atlantic Shores to EPA on September 3, 2024, and Requested by EPA Based on Public Comments Received (Document 5.1.1 in the Docket entitled "5.1.1 Feedback on Comment Letters for EPA Sep 3 2024", originally provided as an attachment to Document 5.2.1 in the Docket). Attachment includes full document.

Attachment 12: BOEM's July 1, 2024 Joint Record of Decision for the Atlantic Shores Offshore Wind South Project (Document 4.1 in the Docket entitled "4.1 BOEM Atlantic Shores South ROD"). Attachment contains document excerpts.

Attachment 13: December 1, 2022 Letter from Suilin Chan to A. J. Jablonowski (Document 2.1.4 in the Docket entitled "2.1.4 EPA Dec 1 2022 Comments on Oct 28 2022 AS Submittal"). Attachment includes full document.

Attachment 14: September 3, 2024 Email from Tim Allen (FWS) to Suilin Chan et al. (EPA) (Document 6.4 in the Docket entitled "6.4 FWS Emails to EPA Sep 3 2024"). Attachment includes full document.

Attachment 15: Documents 6.1, 6.2, 6.3, 6.4, 6.5, and 6.6 from the Administrative Record Regarding FWS Review (Provided in full). These documents are identified in the docket on Regulations.gov as:

"6.1 FWS Emails to EPA July 31 2024"
"6.2 FWS Emails to EPA Aug 27 to 28 2024" *(Administrative Record copy redacted for deliberative process)*
"6.3 FWS Emails to EPA Aug 30 to Sep 3 2024" *(Administrative Record copy redacted for deliberative process)*
"6.4 FWS Emails to EPA Sep 3 2024"
"6.5 FWS Emails to EPA Aug 28 to Sep 5 2024"
"6.6 FWS Emails to EPA Sep 18 to Sep 24 2024"

Attachment 16: BOEM's Final Environmental Impact Statement, Volume I (Document 4.4.1 in the Docket entitled "4.4.1 BOEM FEIS Volume I"). Attachment contains document excerpts.

Attachment 17: March 29, 2023 Email Containing Atlantic Shores March 7, 2023 Modeling Memo (Content in Black Italics) and EPA Responses (Document 3.4.1 in the Docket entitled "3.4.1 Atlantic Shores Modeling Memo 3 7 2023 EPA"). Attachment includes full document.

Attachment 18: Article by R. Lacal-Aránteguia *et al.* entitled "Offshore wind installation: Analysing the evidence behind improvements in installation time." (Document 5.1.4 in the Docket entitled "5.1.4 2018 Offshore W. Analysing...Improvements Installation Time"). Attachment contains document excerpts.

Attachment 2:

Letter from Suilin Chan to Kyle Hilberg dated August 21, 2023 finding the OCS Air Permit Application for Atlantic Shores Project 1 and Project 2 complete

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 2
290 BROADWAY

NEW YORK, NY 10007-1866

August 21, 2023

VIA ELECTRONIC MAIL

Kyle.Hilberg@atlanticshoreswind.com
Mr. Kyle Hilberg
Permitting Lead
Atlantic Shores Offshore Wind

Re: Atlantic Shores Offshore Wind, LLC – Outer Continental Shelf Air Permit Application Completeness Determination

Dear Mr. Hilberg:

On September 1, 2022, the United States Environmental Protection Agency ("EPA") Region 2 Office received an air permit application ("application" or "submittal") from Atlantic Shores Offshore Wind, LLC ("Atlantic Shores" or "AS") for the proposed Atlantic Shores Offshore Wind Farm Projects 1 and 2 ("project") located in Lease OCS-A 0499, at approximately 8.7 miles from the New Jersey shoreline. The application was submitted pursuant to the Outer Continental Shelf (OCS) air regulations codified at 40 C.F.R. part 55. The Atlantic Shores September 2022 submittal was deficient, missing significant components. Following the September application, Atlantic Shores submitted revisions to the information in its application as well as other additional supporting documentation on multiple dates, most recently on June 30 and July 20, 2023. Pursuant to 40 C.F.R. § 124.3(c), the EPA has reviewed your application, including all supplemental submittals, and as provided at 40 C.F.R. § 124.3(f) hereby informs you that your application is deemed complete as of August 21, 2023.

Please be advised that this completeness determination is distinct from a finding of approvability. We are continuing to process your application and will inform you of our preliminary determination (i.e., the approvability status of the project) as soon as it becomes available. However, to date, EPA has already identified concerns that may prevent approvability if not addressed by additional submittals in a timely manner. These concerns/issues are discussed in further detail in Attachment 1 to this letter. As you know, some of these concerns/issues are not new, they have been raised to Atlantic Shores' attention multiple times during prior meeting discussions, the most recent meeting being August 16, 2023. The U.S. Fish and Wildlife Service ("FWS") has informed EPA on August 18, 2023 that it requires additional information from AS to conduct its approvability review. This communication is included as Attachment 2 to this letter. Please provide the additional information to the FWS with a courtesy copy to EPA. Upon completing its review, the FWS will provide EPA with its review findings. Note that input from the FWS will be considered in EPA's approvability analysis.

The information requested in Attachments 1 and 2 to this letter must be received by EPA by September 11, 2023. If a complete response will not be possible by this date, please reach out to us for a conversation, as quick resolutions of these issues are prudent.

The OCS regulations at 40 C.F.R. § 55.6(a)(l)(i) provide for the applicant to submit all information needed by EPA to perform any analysis or make any determination under 40 C.F.R. § 55.6. Therefore, although your application is deemed complete, EPA may identify, in the course of its review, further information to be submitted that may be essential in assisting us in the decision-making process for this OCS project, including information that may be needed to respond to public comments.

We look forward to continuing to work with you on this project. If you wish to discuss any comments or requests for information listed in the attachments or have any questions, please contact Annamaria Colecchia of my staff at 212-637-4016 or colecchia.annamaria@epa.gov (for issues related to air quality analysis or environmental justice), or Frank Jon at 212-637-4085 or jon.frank@epa.gov (for all other issues).

Sincerely,

SUILIN CHAN Digitally signed by SUILIN CHAN
Date: 2023.08.21 17:20:34 -04'00'

Suilin W. Chan, Supervisor
Permitting Section
Air Programs Branch
Air and Radiation Division

Attachments 1 and 2

cc: A.J. Jablonowski, Epsilon Associates
Joseph Sabato, All 4 Inc.
Scott Bowles, EPA
Emily French, EPA
Catherine Collins, US FWS
Tim Allen, US FWS
Kimberly Sullivan, BOEM
Francis Steitz, NJDEP
Kennett Ratzman, NJDEP
Danny Wong, NJDEP

ATTACHMENT 1

I. Air Quality Impact Assessment

The Atlantic Shores OCS air permit application, though contains the requisite air quality impact assessments, must be supplemented with the supporting information listed below to ensure that the air quality analyses were conducted in accordance with EPA's regulations and guidelines, and to support approvability of this project.

1. Section 2 of the July 20, 2023 submittal titled "Project and Calculation Changes" contains 3 revisions to the September 1, 2022 application. There is insufficient description of how the emission rates were changed from the September 1, 2022 application and how the changes were incorporated into the modeling analysis. The application must include a discussion on any assumptions made that would affect the modeled emission rate. For instance, note that hourly emissions must be modeled for the full 24-hour meteorological period. The emissions may not be averaged across non-operating hours[1]. Please confirm that AS modeled the full 24-hour period and did not average across non-operating hours including for the hydraulic hammer and air compressors. Hourly emissions modeled for less than 24 hours will be so restricted by permit conditions. In addition, please clarify the use of the EMISFACT and HROFDAY keyword in the input files.
2. Please confirm that the modeled emission rates are the maximum hourly emission rates since these will become permit limits.
3. The Significant Impact Area (SIA) extends to 50 km for the 1-hour NO_2 NAAQS for both the construction, and operation and maintenance phases, and for the 24-hour $PM_{2.5}$ NAAQS and Class II increment during the construction phase. Note that we understand that AERMOD's gaussian assumption is not valid beyond 50 km. Please provide information showing that the NAAQS and PSD Class II increment requirements are met beyond 50 km. See section 4.2 of EPA's Guideline on Air Quality Models for further guidance.
4. Please refine your VISCREEN modeling analysis or provide a detailed explanation that demonstrates that the project is in compliance with the 40 C.F.R. § 52.21(o) requirements. EPA first made this request on September 30, 2022 but it has not been addressed by AS and thus, remains outstanding.
5. Given the project's proximity and the preliminary impact analysis on the Class I area AQRVs, the FWS, in its role as the Federal Lands Manager, will need to make a determination regarding the impacts this project will have on the AQRVs in the Class I

[1] *See* 40 C.F.R. Part 51, Appendix W ("Guideline on Air Quality Models"), Table 8-2, footnote 2 states , "If operation does not occur for all hours of the time period of consideration (e.g., 3 or 24-hours) and the source operation is constrained by a federally enforceable permit condition, an appropriate adjustment to the modeled emission rate may be made (e.g., if operation is only 8 a.m. to 4 p.m. each day, only these hours will be modeled with emissions from the source. Modeled emissions should not be averaged across non-operating time periods."

area. Please see Attachment 2 for a discussion of additional information that must be provided to FWS.

6. Please explain what is an "elevated volume source" as it was mentioned in Appendix A of the June 30, 2023 submittal and how it was used in the model.
7. Please explain what a summer campaign is.
8. Below are typo-like comments. Please correct these values in the application:
    a. Several values in Table 3-5 are off when converting from PPB or PPM to ug/m^3. Please note that 40 C.F.R. Part 50 defines Standard Temperature and Pressure as 25 degree C and 1 atmosphere pressure.
    b. NO_2 NJAAQS: Table 3-1 should include the NJ 1-hour NO_2 NJAAQS.
    c. Page 3-2 states: "The NAAQS also reflect various durations of exposure. The short-term periods (24 hours or less) refer to exposure levels not to be exceeded more than once a year. Long-term periods refer to limits that cannot be exceeded for exposure averaged over three months or longer." This quote is inaccurate, please remove it.
    d. Table 3-3: Footnotes should reflect that modeling in this case was averaged across 3 years, not 5 years, since there were 3 years of prognostic data, as allowed by guidance.
    e. Table 3-4, on page 3-5, and Table 5-13 on page 5-9 contain a typo for $PM_{2.5}$ secondary NAAQS. Please change 0.49 ug/m^3 to 15 ug/m^3.
    f. Table 5-2 and 5-5 are missing the annual PM_{10} increment SIL, please add it.
    g. Page 4-18: please add the bolded items below to the bullet pointed list of pollutants that are above the SIL (other items are listed below for context):
        - Construction, 1-hour NO_2
        - Construction, 24-hr $PM_{2.5}$
        - **Add 8 hr CO, annual NO_2, annual $PM_{2.5}$, 24 hr PM_{10}.**
        - O&M, 1-hour NO_2
        - O&M, 24-hour $PM_{2.5}$
        - **Add 8 hr CO**

II. BACT, LAER, and Other Issues

1. We note that your recent submittals specify a revised total OCS construction emission for SO_2 of 7.3 tons. This is considerably lower than other OCS applications under review in EPA Region 2. Page 4-32 of the September 1, 2022 OCS applications states:

    The cleanest fuel oil possible will be used where feasible. Vessels that are not able to use fuel oil that meets the ULSD standard of 15 ppm of sulfur will use fuel oil with a sulfur content less than 1,000 ppm in accordance with the MARPOL Annex VI requirements for Emission Control Areas. Since some of these engines have the potential to use fuels with a fuel sulfur content that exceeds 30 ppm, a case-by-case SOTA determination is required.

    Based upon a brief initial review of the revised Excel spreadsheets, we did not see any emission estimates for any possible use of fuel with sulfur content less than 1,000 ppm or greater than 30 ppm for vessels that are not able to burn ULSD; we only saw calculations using ULSD (15 ppm sulfur) fuel. AS is advised to check the accuracy of its estimated total construction SO_2 emissions of 7.3 tons as it will become a limit in the permit.

2. Provide a simple table listing all potential vessels that will be utilized for this project; whether the vessel will be US or foreign-flagged; and which vessel(s) are anticipated to be an OCS source. Note that absent this information identifying which vessels are anticipated to be OCS sources and why, EPA may need to treat all vessels as OCS sources in the draft permit, and include all accompanying requirements.

3. Provide a table listing each vessel, its marine engines including the category of each engine, and for each engine its size in kilowatt (kW), applicable part 1042 emission standard or NOx Tier emission standard under MARPOL Annex VI, and the emission factors (g/kW-hr) for each air pollutant that AS used for the calculations. Also, the origin of each emission rate and/or how it was derived must be provided.

   a. Note that, as discussed by phone on August 16, 2023, 40 C.F.R. § 55.7 provides that an OCS source may be exempted from a control technology requirement if EPA finds that compliance with the control technology requirement is technically infeasible or will cause an unreasonable threat to health and safety.
   b. Also note that, as discussed by phone on August 16, 2023, 40 C.F.R. § 60.8(b) includes provisions for seeking performance test waivers in certain circumstances.

4. EPA reiterates that AS must submit the offset demonstration required by N.J.A.C. 7:27-18.3(e) and previously identified in our September 30, 2022 incompleteness letter. AS must submit the following two forms to NJDEP:
   a. CER02 - Identification of Creditable Emission Reductions (CERs) for Transfer
   b. CER03 - Joint Request for Transfer Of Creditable Emission Reductions (CERs)

   AS must submit CER02 as part of its application and may choose whether to submit CER03 as part of the application or at a later time prior to public notice and comment on the draft OCS air permit. These forms can be found on NJDEP's web site at https://www.state.nj.us/dep/aqpp/applying.html. Once completed, the forms should be transmitted to NJDEP. As part of AS's response to this request, please provide, at a minimum, CER02. AS's application will not be approvable without submission of this form.

ATTACHMENT 2

From: Allen, Tim
To: Colecchia, Annamaria (she/her/hers)
Cc: Sareen, Neha (she/her/hers); Carlucci, John X; Cragan, Clare E; Rettig, Virginia; Vail-Muse, Stephanie Vail-Muse L; Ming, Jaron E; Collins, Catherine
Subject: Completeness Statement on Atlantic Shores (small correction)
Date: Friday, August 18, 2023 3:28:17 PM

Hi Annamaria,

Thank you for coordinating with the Fish and Wildlife Service (FWS) on the Outer Continental Shelf (OCS) air quality permit application completeness determination for the Atlantic Shores Offshore Wind, LLC (Atlantic Shores) South Wind Project. The FWS has reviewed the September 1, 2022 OCS air permit application, the October 28, 2022 Epsilon Response to Comments, the December 16, 2022 revision to the air permit application, and the modeling files and report submitted in July 2023.

This project is planned to be constructed near the Clean Air Act Class I Brigantine Wilderness Area in the Edwin B. Forsythe National Wildlife Refuge, FWS has an affirmative responsibility to evaluate any potential air quality and Air Quality Related Values (AQRVs) impacts. The FWS has the following comments and is requesting additional information is provide so that we can determine any potential impacts the Air Quality or AQRVs to the Class I area.

The OCS air permit application history provides an evaluation of AQRVs from the initial emissions associated with the construction phase. This early construction phase of the project is described as taking approximately 2 - 3 years of a planned 30-year operational life. The air quality analysis showed that during the short-lived construction phase that there would be impacts to the Class I area.

In Epsilon's response to EPA's comments dated October 28, 2022 (page 13) the statement is made "We conservatively modeled construction impacts only because operation impacts will be much lower." Though we agree that construction phase emissions will be much higher than those associated with operation and maintenance, it is equally important to understand how the long-term activities (30-year operational project lifetime) will impact the Brigantine Wilderness.

Between the December 2022 response to comments and the July 2023 modeling report, it appears that the short-term emission limits did not decrease significantly. It was our understanding during some coordination conversations that these limits would decrease. Please provide an explanation of the changes.

Additionally, with the high impact estimates from the construction phase, we acknowledge Epsilon's statement that "We expect to move to the mitigation measures portion of the FLAG Guidance as described in Section 4. Atlantic Shores will discuss alternative mitigation measures with the U.S. Fish and Wildlife Services." (Page 4, October 28, 2022, Epsilon Response to Comments).

In order to determine whether the AQRV impacts are only associated with construction, the FWS is requesting that Atlantic Shores South evaluate the potential air quality and AQRV impacts of the long-term operation and maintenance activities at Brigantine Wilderness Area (without construction).

In addition, please provide a summary table of emissions and impact results to the Class I area (Brigantine) associated with long-term operation & maintenance activities. We would appreciate if Epsilon highlighted the differences between construction activity/emissions and those from operation/maintenance in the short-term (24-hour maximums). We'd ask that modeling *.inp and *.lst files associated with the CALPUFF modeling system runs be provided.

FWS considers this application complete but has concerns regarding the approvability of the project as it relates to long-term potential impacts at the Class I area. We are requesting the applicant provide the additional analysis so that we may evaluate all aspects of the development.

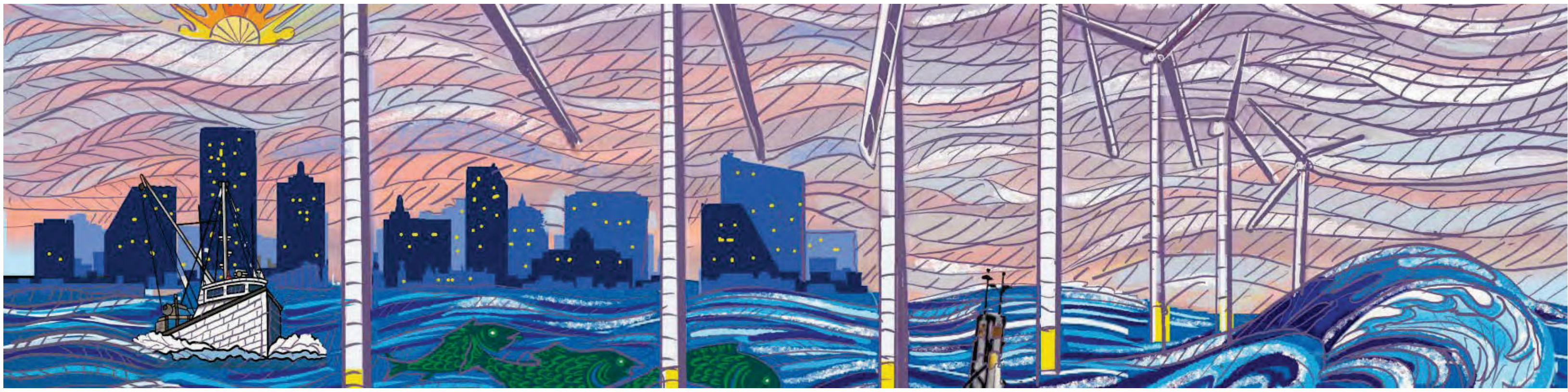
We are in the process of evaluating contributions to cumulative Class I AQRV impacts to the wilderness from similar development. Additional information may be requested in support of that effort.

Thank you for keeping us informed and involving the Fish and Wildlife Service in the project review.

Catherine Collins
Tim Allen

Attachment 3:

Final Permit Application submitted by Atlantic Shores Offshore Wind Project 1, LLC on June 28, 2024



Atlantic Shores Offshore Wind

Outer Continental Shelf Air Permit Application

Atlantic Shores Offshore Wind

Outer Continental Shelf Air Permit Application

Prepared for:
Atlantic Shores Offshore Wind Project 1, LLC

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

September 1, 2022
Revised June 2024

Atlantic Shores Offshore Wind

Outer Continental Shelf Air Permit Application

Prepared for:

Atlantic Shores Offshore Wind Project 1, LLC

Prepared by:

Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

September 1, 2022
revised June 2024

Executive Summary

Purpose of the Application

Atlantic Shores Offshore Wind Project 1, LLC ("Atlantic Shores") proposes to construct, operate, and decommission two offshore wind energy generation projects in Lease Area OCS-A 0499. Atlantic Shores accordingly seeks a permit for emissions associated with sources subject to the Outer Continental Shelf (OCS) Air Regulations at 40 CFR Part 55.

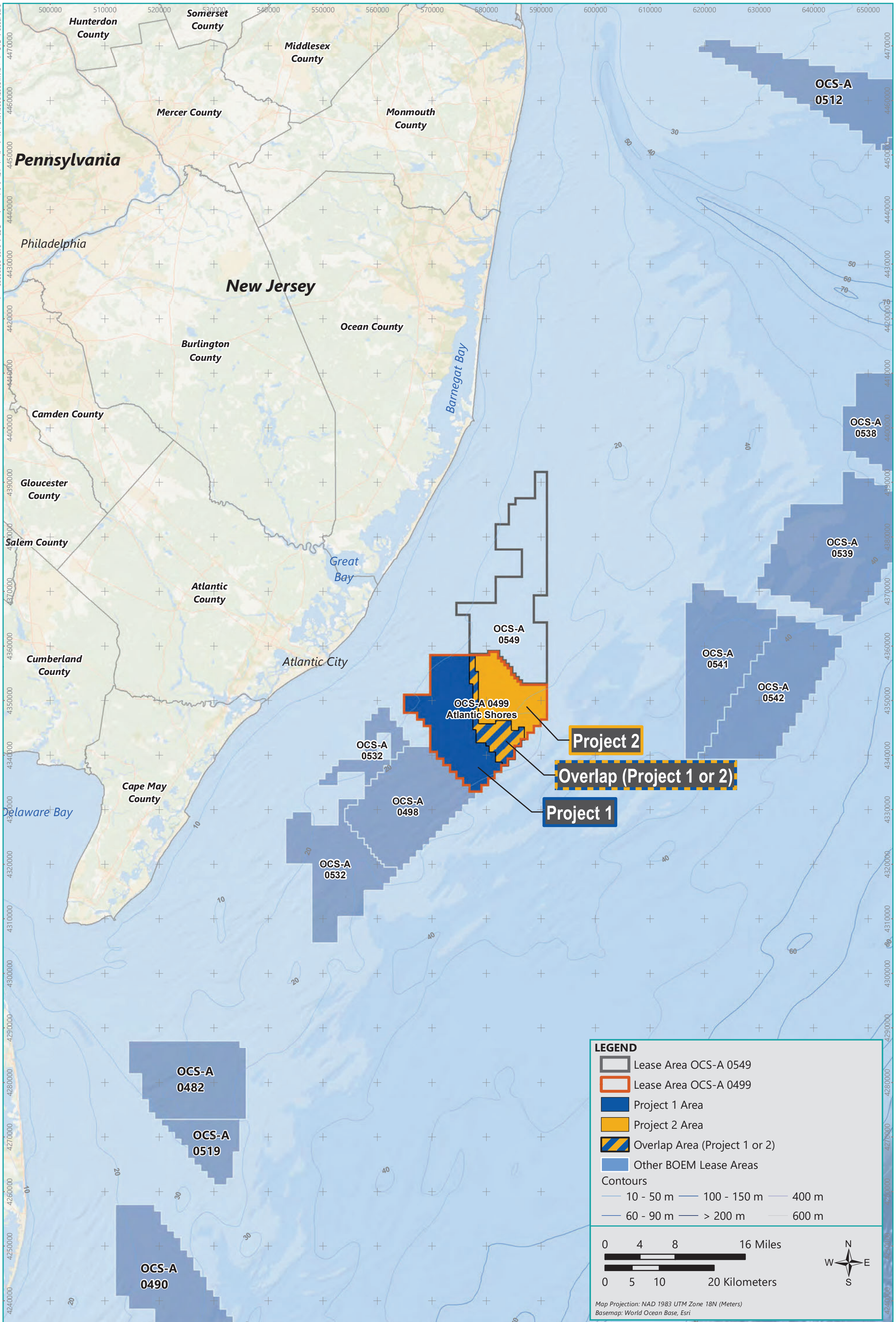
Description of the Projects

Atlantic Shores is a 50/50 joint venture between EDF-RE Offshore Development, LLC (a wholly owned subsidiary of EDF Renewables, Inc. [EDF Renewables]) and Shell New Energies US LLC (Shell). Atlantic Shores is submitting this Outer Continental Shelf (OCS) air permit application to the United States Environmental Protection Agency (EPA) for the development of two offshore wind energy generation projects within Lease Area OCS-A 0499 (the Lease Area). Project 1 and Project 2 are collectively referred to as "the Projects." Based on an administrative change in ownership approved by EPA pursuant to 40 C.F.R. § 71.7, Atlantic Shores Offshore Wind Project 1, LLC is the applicant for this Clean Air Act OCS permit and is the owner of Project 1 and an affiliate of the Atlantic Shores Project 2 Company. Upon EPA's approval and issuance of the requested Clean Air Act OCS permit, Atlantic Shores Offshore Wind Project 1, LLC will be the holder of this permit.

The purpose of these projects is to develop offshore wind energy generation facilities within the Lease Area to provide clean, renewable energy to the Northeastern U.S. by the mid-to-late 2020s. The projects will help both the U.S. and New Jersey achieve their renewable energy goals, diversify the State's electricity supply, increase electricity reliability, and reduce greenhouse gas (GHG) emissions. The projects will also provide numerous environmental, health, community, and economic benefits, such as the creation of substantial new employment opportunities, including within disadvantaged communities.

Atlantic Shores will develop Lease Area OCS-A 0499 as two projects. Project 1 and Project 2 are collectively referred to as "the Projects." The two Projects will have a combined maximum of 200 wind turbine generators (WTGs) and a maximum of ten offshore substations (OSSs). Both Projects will have associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities.

The Projects are in federal waters on the Outer Continental Shelf (OCS), just over 8.7 statute miles (mi) (14 kilometers [km]) from the New Jersey shoreline. Project 1 is located in the western portion of the Lease Area (also referred to as the Wind Turbine Area [WTA]) and Project 2 is located in the eastern portion of the WTA, with an Overlap Area that could be used by either Project 1 or Project 2. The Overlap Area is included in the



ATLANTIC SHORES offshore wind

Figure 1-1
Atlantic Shores Lease Area OCS-A 0499
Offshore New Jersey

Pile Driving of a Monopile

Transition Piece Installation from a Jack-Up Vessel

Monopile Transport via Tugboat and Barge

Pile Driving of a Jacket Pile

ATLANTIC SHORES offshore wind

Figure 1-5
Piled Foundation Transportation and Installation

VOC emissions:

Logan Generating Plant = 9.09 TPY VOC * 1.0 * 1.0 / 1.3 = 6.99 TPY VOC

On June 17, 2024, the State of New Jersey approved the identification of the following Creditable Emission Reductions (CERs) for transfer to Atlantic Shores: 9.09 TPY VOC and 404.13 TPY NOx from the Logan Generating Plant and 126.4 TPY NOx from Carneys Point. On June 24, 2024, the State of New Jersey approved and transferred ownership of these CERs to Atlantic Shores. The CER Approvals and CER Transfer Report are included as Appendix E to this application.

3.9.3 Alternative sites, sizes, and processes

Per N.J.A.C. 7:27-18.3(c)2., this section provides an analysis of alternative sites within New Jersey, and of alternative sizes, production processes, including pollution prevention measures, and environmental control techniques, demonstrating that the benefits of the newly constructed, reconstructed, or modified equipment significantly outweigh the environmental and social costs imposed as a result of the location, construction, reconstruction or modification and operation of such equipment. Each portion of this analysis is taken in-turn.

- Alternative sites within New Jersey: The WTA is located within the New Jersey Wind Energy Area (NJWEA). The NJWEA was identified as suitable for offshore renewable energy development by the Bureau of Ocean Energy Management (BOEM) through a multi-year, public environmental review process. Through this review process, the NJWEA was sited to exclude areas of high value habitat and conflicting water and air space uses. Further information is available in Volume 1 Section 1.3.1 of the COP, and in information presented by NJDEP[7]. Other lease areas within the NJWEA are being developed by Atlantic Shores or other developers for offshore wind use.
- The State of New Jersey recognized the value of offshore locations for energy production in issuance of the New Jersey Offshore Wind Economic Development Act (OWEDA). Atlantic Shores is developing the Projects in response to New Jersey offshore wind energy solicitations. Development onshore would not respond to these solicitations.
- Alternative sizes and production processes: Atlantic Shores has sited the Projects' facilities and developed the Project Design Envelope (PDE) to maximize renewable energy production, minimize environmental effects, minimize cost to ratepayers, and address stakeholder concerns. The PDE articulates the maximum design scenario for key project components, such as the type and number of WTGs, foundation types, OSS types, cable types, and

7 https://www.nj.gov/dep/offshorewind/projects.html, accessed 8/27/2022

installation techniques. The PDE provides Atlantic Shores with the necessary flexibility to respond to anticipated advancements in industry technologies and techniques, that even under a maximum scenario will not exceed an unreasonable level of environmental effects.

- Pollution prevention measures and environmental control techniques: As described below the Projects themselves are pollution control measures, because they will allow for the displacement of existing fossil fuel electric generation and its associated pollution. Per Section 4 of this OCS air permit application, air quality control measures for OCS sources meet applicable LAER, BACT, and SOTA requirements. Overall air quality control measures are described in Volume 2 Section 3.1 of the COP, and Volume 2 of the COP more broadly presents Potential Impacts and Proposed Environmental Protection Measures related to environmental setting, physical resources including air and water, biological resources, visual resources, cultural resources, socioeconomic resources, noise, and public health & safety.
- Demonstration that the benefits significantly outweigh the environmental and social costs: The Projects will result in a significant net decrease in harmful air pollutant emissions region-wide by displacing electricity from fossil fuel power plants.

Available data on avoided emissions is summarized in Table 3-3, based on the Project 1 nameplate capacity of 1,510 MW and Project 2 target capacity of 1,327 MW; each with 50% capacity factor and 4% transmission losses displacing the latest-available output emission rate for the Reliability First Corporation (RFC) East subregion as published by the EPA (EPA 2020a).

TABLE 3-3 AVOIDED AIR EMISSIONS[1]

	NO_X, TONS/YEAR	$PM_{2.5}$, TONS/YEAR	SO_2, TONS/YEAR	CO_2E, TONS/YEAR
PROJECT 1	2,162	153	2,549	3,964,000
PROJECT 2[2]	1,374	97	1,621	2,520,000

1 Based on the non-baseload output emission rate for NO_x, SO_2, and CO_2e; based on the total output emission rate for $PM_{2.5}$.

2 Based on a reasonable minimum Project 2 size of 960 MW.

The emissions savings shown in Table 3-3 provide only a partial description of the air quality-related benefits of the Projects, for the following reasons:

- Traditional power plants do not include emissions associated with plant construction, fuel delivery, maintenance, worker commute, safety systems, vehicles, or machinery when reporting direct emissions.

- The Project will also avoid emissions of HAPs including mercury, acrolein, formaldehyde, and cadmium associated with fossil fuel generation.
- The emissions reductions will occur at fossil fuel power plants that tend to be near population centers, or upwind of population centers, including overburdened Environmental Justice communities. Project-related air emissions will predominately occur offshore away from population centers.

The Projects' avoided emissions will benefit human health and the environment over the entire operational life of the Projects.

3.10 Environmental Justice

3.10.1 New Jersey Environmental Justice Legislation

New Jersey has enacted Environmental Justice legislation (N.J.S.A. 13:1D-157, et seq.) protect overburdened communities which have been historically subject to a disproportionately high number of environmental and public health stressors. The law defines overburdened communities, and directs agencies to enact regulations focused on protecting those communities.

Implementing regulations are under development, including proposed new rules at N.J.A.C. 7:1C. NJDEP's Administrative Order No. 2021-25A extends public comment opportunities for certain permit issuances and renewals in mapped environmental justice communities. Because this OCS air permit application addresses activities in the WTA, and because the WTA is entirely offshore and so is not located in an overburdened community, this OCS air permit application is not subject to the legislation or the administrative order, and would not be subject to the implementing regulations. Onshore portions of the Projects do not require significant environmental permits, and would not trigger review under the legislation, the administrative order, or the proposed regulations.

3.10.2 Federal Executive Order

Executive Order 12898 of February 11, 1994 titled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" states: "…each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…" The air emissions that are the subject of this OCS air permit application will not have effects on minority or low-income populations that are either disproportionally high or adverse. As shown in the separate Modeling Report, peak air quality impacts from proposed operations are entirely over water, several miles from any minority or low-income populations. The

Activity	Representative Vessel Type	Engine Type	Engine Count	Engine Size (kW)	Total Size (kW)	Engine Category	Home Port	Vessel Trips	One-Way Trip Distance (NM)	Total Distance Traveled (NM)	Vessel Transit Speed (knots)	Hours in Transit/Year	Operating Days in WTA/Year	Operating Hours/Day	Total Non-Transit Hours	Total Operating Hours	Emission Factors Ref
US Towing Tug 2	US Towing Tug	Main Engine (Transit)	2	2,525	5,050	1 & 2 main	NJWP	6	91	1,095	10	109	0	0	0	109	11M
		Main Engine (Maneuvering)	2	2,525	5,050	1 & 2 main		0	91	0	10	0	10	24	240	240	11M
		Auxiliary Engine (Transit)	3	79	236	1 & 2 auxiliary		6	91	1,095	10	109	0	0	0	109	11A
		Auxiliary Engine (Maneuvering)	3	79	236	1 & 2 auxiliary		0	91	0	10	0	10	24	240	240	11A
US Towing Tug 3	US Towing Tug	Main Engine (Transit)	2	2,525	5,050	1 & 2 main	NJWP	6	91	1,095	10	109	0	0	0	109	11M
		Main Engine (Maneuvering)	2	2,525	5,050	1 & 2 main		0	91	0	10	0	10	24	240	240	11M
		Auxiliary Engine (Transit)	3	79	236	1 & 2 auxiliary		6	91	1,095	10	109	0	0	0	109	11A
		Auxiliary Engine (Maneuvering)	3	79	236	1 & 2 auxiliary		0	91	0	10	0	10	24	240	240	11A
US Towing Tug 4	US Towing Tug	Main Engine (Transit)	2	2,525	5,050	1 & 2 main	NJWP	6	91	1,095	10	109	0	0	0	109	11M
		Main Engine (Maneuvering)	2	2,525	5,050	1 & 2 main		0	91	0	10	0	10	24	240	240	11M
		Auxiliary Engine (Transit)	3	79	236	1 & 2 auxiliary		6	91	1,095	10	109	0	0	0	109	11A
		Auxiliary Engine (Maneuvering)	3	79	236	1 & 2 auxiliary		0	91	0	10	0	10	24	240	240	11A
	Crew Transfer Vessel	Main Engine (Transit)	4	522	2,088	1 & 2 main	Atlantic City	14	17	487	29	17	0	0	0	17	4M
		Main Engine (Maneuvering)	4	522	2,088	1 & 2 main		0	17	0	29	0	56	24	1,344	1,344	4M
		Auxiliary Engine (Transit)	2	27	54	1 & 2 auxiliary		14	17	487	29	17	0	0	0	17	4A
		Auxiliary Engine (Maneuvering)	2	27	54	1 & 2 auxiliary		0	17	0	29	0	56	24	1,344	1,344	4A
	Bubble Curtain Power	Air Compressor	20	399	7,980	Stage III B	N/A	0	0	0	0	0	18	10	180	180	16
	Hydraulic Hammer Power	Hammer Engine	3	597	1,791	Tier 2 Non-Road	N/A	0	0	0	0	0	18	10	180	180	18
Scour Protection																	
	Fall Pipe Vessel	Main Engine (Transit)	8	4 x 3350kW 4 x 2000kW	21,400	1 & 2 main	Europe	2	250	1,000	10	100	0	0	0	100	3M
		Main Engine (Maneuvering)	8	4 x 3350kW 4 x 2000kW	21,400	1 & 2 main		0	250	0	10	0	92	24	2,208	2,208	3M
		Auxiliary Engine (Transit)	1	2,950	2,950	1 & 2 auxiliary		2	250	1,000	10	100	0	0	0	100	3A
		Auxiliary Engine (Maneuvering)	1	2,950	2,950	1 & 2 auxiliary		0	250	0	10	0	92	24	2,208	2,208	3A
	US Dredger	Main Engine (Transit)	2	641	1,283	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	5M
		Main Engine (Maneuvering)	2	641	1,283	1 & 2 main		0	91	0	10	0	58	24	1,392	1,392	5M
		Auxiliary Engine (Transit)	1	954	954	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	5A
		Auxiliary Engine (Maneuvering)	1	954	954	1 & 2 auxiliary		0	91	0	10	0	58	24	1,392	1,392	5A
Inter Array Cable Installation																	
Cable Installation Vessel	Cable Installation Vessel	Main Engine (Transit)	1	7,280	7,280	1 & 2 main	Europe	2	250	1,000	10	100	0	0	0	100	3M
		Main Engine (Maneuvering)	1	7,280	7,280	1 & 2 main		0	250	0	10	0	220	24	5,280	5,280	3M
		Auxiliary Engine (Transit)	1	220	220	1 & 2 auxiliary		2	250	1,000	10	100	0	0	0	100	3A
		Auxiliary Engine (Maneuvering)	1	220	220	1 & 2 auxiliary		0	250	0	10	0	220	24	5,280	5,280	3A
Cable Installation Support Activities	Support Vessel/SOV	Main Engine (Transit)	4	1,200	4,800	1 & 2 main	Europe	2	250	1,000	10	100	0	0	0	100	3M
		Main Engine (Maneuvering)	4	1,200	4,800	1 & 2 main		0	250	0	10	0	138	24	3,307	3,307	3M
		Auxiliary Engine (Transit)	1	800	800	1 & 2 auxiliary		2	250	1,000	10	100	0	0	0	100	3A
		Auxiliary Engine (Maneuvering)	1	800	800	1 & 2 auxiliary		0	250	0	10	0	138	24	3,307	3,307	3A
Sand Wave Clearance	TSHD (Dredger)	Main Engine (Transit)	2	641	1,283	1 & 2 main	Europe	2	250	1,000	10	100	0	0	0	100	5M
		Main Engine (Maneuvering)	2	641	1,283	1 & 2 main		0	250	0	10	0	144	24	3,453	3,453	5M
		Auxiliary Engine (Transit)	1	954	954	1 & 2 auxiliary		2	250	1,000	10	100	0	0	0	100	5A
		Auxiliary Engine (Maneuvering)	1	954	954	1 & 2 auxiliary		0	250	0	10	0	144	24	3,453	3,453	5A
Pre Lay Grapnel Run AHTS 1	AHTS	Main Engine (Transit)	2	4,500	9,000	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	11M
		Main Engine (Maneuvering)	2	4,500	9,000	1 & 2 main		0	91	0	10	0	21	24	507	507	11M
		Auxiliary Engine (Transit)	2	410	820	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	11A
		Auxiliary Engine (Maneuvering)	2	410	820	1 & 2 auxiliary		0	91	0	10	0	21	24	507	507	11A
Pre Lay Grapnel Run AHTS 2	AHTS	Main Engine (Transit)	2	4,500	9,000	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	11M
		Main Engine (Maneuvering)	2	4,500	9,000	1 & 2 main		0	91	0	10	0	21	24	507	507	11M
		Auxiliary Engine (Transit)	2	410	820	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	11A
		Auxiliary Engine (Maneuvering)	2	410	820	1 & 2 auxiliary		0	91	0	10	0	21	24	507	507	11A
Post-Install Rock Protection	Rock Dumping Vessel (Fall Pipe Vessel)	Main Engine (Transit)	8	4 x 3350kW 4 x 2000kW	21,400	1 & 2 main	Europe	2	250	1,000	10	100	0	0	0	100	3M
		Main Engine (Maneuvering)	8	4 x 3350kW 4 x 2000kW	21,400	1 & 2 main		0	250	0	10	0	3	24	67	67	3M
		Auxiliary Engine (Transit)	1	2,950	2,950	1 & 2 auxiliary		2	250	1,000	10	100	0	0	0	100	3A
		Auxiliary Engine (Maneuvering)	1	2,950	2,950	1 & 2 auxiliary		0	250	0	10	0	3	24	67	67	3A
WTG Installation																	
WTG Installation Vessel	Jackup Vessel	Main Engine (Transit)	7	4 x 3,535kW 3 x 2,650kW	22,090	3 main	NJWP	2	91	365	10	36	0	0	0	36	7M
		Main Engine (Maneuvering)	7	4 x 3,535kW 3 x 2,650kW	22,090	3 main		0	91	0	10	0	517	24	12,410	12,410	7M
		Auxiliary Engine (Transit)	1	2,650	2,650	3 Auxiliary		2	91	365	10	36	0	0	0	36	7A
		Auxiliary Engine (Maneuvering)	1	2,650	2,650	3 Auxiliary		0	91	0	10	0	517	24	12,410	12,410	7A
US Jack Up Feeder 1	Jack up	Main Engine (Transit)	2	2,500	5,000	3 main	NJWP	100	91	18,249	10	1,825	0	0	0	1,825	7M
		Main Engine (Maneuvering)	2	2,500	5,000	3 main		0	91	0	10	0	238	24	5,723	5,723	7M
		Auxiliary Engine (Transit)	1	2,500	2,500	1 & 2 auxiliary		100	91	18,249	10	1,825	0	0	0	1,825	7A
		Auxiliary Engine (Maneuvering)	1	2,500	2,500	1 & 2 auxiliary		0	91	0	10	0	238	24	5,723	5,723	7A

Activity	Representative Vessel Type	Engine Type	Engine Count	Engine Size (kW)	Total Size (kW)	Engine Category	Home Port	Vessel Trips	One-Way Trip Distance (NM)	Total Distance Traveled (NM)	Vessel Transit Speed (knots)	Hours in Transit/Year	Operating Days in WTA/Year	Operating Hours/Day	Total Non-Transit Hours	Total Operating Hours	Emission Factors Ref
US Jack Up Feeder 2	Jack up	Main Engine (Transit)	2	2,500	5,000	3 main	NJWP	100	91	18,249	10	1,825	0	0	0	1,825	7M
		Main Engine (Maneuvering)	2	2,500	5,000	3 main		0	91	0	10	0	238	24	5,723	5,723	7M
		Auxiliary Engine (Transit)	1	2,500	2,500	1 & 2 auxiliary		100	91	18,249	10	1,825	0	0	0	1,825	7A
		Auxiliary Engine (Maneuvering)	1	2,500	2,500	1 & 2 auxiliary		0	91	0	10	0	238	24	5,723	5,723	7A
Crew Transfer	Crew Transfer Vessel	Main Engine (Transit)	4	522	2,088	1 & 2 main	Atlantic City	130	17	4,519	29	159	0	0	0	159	4M
		Main Engine (Maneuvering)	4	522	2,088	1 & 2 main		0	17	0	29	0	517	24	12,410	12,410	4M
		Auxiliary Engine (Transit)	2	27	54	1 & 2 auxiliary		130	17	4,519	29	159	0	0	0	159	4A
		Auxiliary Engine (Maneuvering)	2	27	54	1 & 2 auxiliary		0	17	0	29	0	517	24	12,410	12,410	4A
WTG Commissioning SOV	Service Operation Vessel	Main Engine (Transit)	4	1,200	4,800	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	3M
		Main Engine (Maneuvering)	4	1,200	4,800	1 & 2 main		0	91	0	10	0	517	24	12,410	12,410	3M
		Auxiliary Engine (Transit)	1	800	800	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	3A
		Auxiliary Engine (Maneuvering)	1	800	800	1 & 2 auxiliary		0	91	0	10	0	517	24	12,410	12,410	3A
Export Cable Installation																	
Cable Installation Vessel 1	Cable Installation Vessel	Main Engine (Transit)	4	2 x 2560kW 2 x 1913kW	8,946	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	3M
		Main Engine (Maneuvering)	4	2 x 2560kW 2 x 1913kW	8,946	1 & 2 main		0	91	0	10	0	348	24	8,352	8,352	3M
		Auxiliary Engine (Transit)	2	1,400	2,800	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	3A
		Auxiliary Engine (Maneuvering)	2	1,400	2,800	1 & 2 auxiliary		0	91	0	10	0	348	24	8,352	8,352	3A
Cable Installation Vessel 2	Cable Installation Vessel	Main Engine (Transit)	4	2 x 2560kW 2 x 1913kW	8,946	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	3M
		Main Engine (Maneuvering)	4	2 x 2560kW 2 x 1913kW	8,946	1 & 2 main		0	91	0	10	0	348	24	8,352	8,352	3M
		Auxiliary Engine (Transit)	2	1,400	2,800	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	3A
		Auxiliary Engine (Maneuvering)	2	1,400	2,800	1 & 2 auxiliary		0	91	0	10	0	348	24	8,352	8,352	3A
Support and Jointing Vessel	Support Vessel	Main Engine (Transit)	3	2 x 2350kW 1 x 1786kW	6,486	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	3M
		Main Engine (Maneuvering)	3	2 x 2350kW 1 x 1786kW	6,486	1 & 2 main		0	91	0	10	0	70	24	1,680	1,680	3M
		Auxiliary Engine (Transit)	2	994	1,988	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	3A
		Auxiliary Engine (Maneuvering)	2	994	1,988	1 & 2 auxiliary		0	91	0	10	0	70	24	1,680	1,680	3A
TSHD	Dredger	Main Engine (Transit)	2	641	1,283	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	5M
		Main Engine (Maneuvering)	2	641	1,283	1 & 2 main		0	91	0	10	0	253	24	6,072	6,072	5M
		Auxiliary Engine (Transit)	1	954	954	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	5A
		Auxiliary Engine (Maneuvering)	1	954	954	1 & 2 auxiliary		0	91	0	10	0	253	24	6,072	6,072	5A
AHTS	Tug	Main Engine (Transit)	2	4,500	9,000	1 & 2 main	NJWP	2	91	365	10	36	0	0	0	36	11M
		Main Engine (Maneuvering)	2	4,500	9,000	1 & 2 main		0	91	0	10	0	103	24	2,472	2,472	11M
		Auxiliary Engine (Transit)	2	410	820	1 & 2 auxiliary		2	91	365	10	36	0	0	0	36	11A
		Auxiliary Engine (Maneuvering)	2	410	820	1 & 2 auxiliary		0	91	0	10	0	103	24	2,472	2,472	11A
Post-Install Rock Protection	Rock Dumping Vessel (Fall Pipe Vessel)	Main Engine (Transit)	8	4 x 3350kW 4 x 2000kW	21,400	1 & 2 main	Europe	2	250	1,000	10	100	0	0	0	100	3M
		Main Engine (Maneuvering)	8	4 x 3350kW 4 x 2000kW	21,400	1 & 2 main		0	250	0	10	0	6	24	144	144	3M
		Auxiliary Engine (Transit)	1	2,950	2,950	1 & 2 auxiliary		2	250	1,000	10	100	0	0	0	100	3A
		Auxiliary Engine (Maneuvering)	1	2,950	2,950	1 & 2 auxiliary		0	250	0	10	0	6	24	144	144	3A
Fuel Bunkering																	
Towing Tug	Tug	Main Engine (Transit)	2	2,525	5,050	1 & 2 main	NJWP	24	91	4,380	10	438	0	0	0	438	11M
		Main Engine (Maneuvering)	2	2,525	5,050	1 & 2 main		0	91	0	10	0	168	24	4,032	4,032	11M
		Auxiliary Engine (Transit)	3	79	236	1 & 2 auxiliary		24	91	4,380	10	438	0	0	0	438	11A
		Auxiliary Engine (Maneuvering)	3	79	236	1 & 2 auxiliary		0	91	0	10	0	168	24	4,032	4,032	11A
Barge	Barge	Main Engine (Transit)	0	0	0	1 & 2 main	NJWP	24	91	4,380	10	438	0	0	0	438	2M
		Main Engine (Maneuvering)	0	0	0	1 & 2 main		0	91	0	10	0	168	24	4,032	4,032	2M
		Auxiliary Engine (Transit)	1	50	50	1 & 2 auxiliary		24	91	4,380	10	438	0	0	0	438	2A
		Auxiliary Engine (Maneuvering)	1	50	50	1 & 2 auxiliary		0	91	0	10	0	168	24	4,032	4,032	2A
Motion Compensation	Motion Compensation	Motion Compensation Engine	1	500	500	Tier 3 Non-Road	NJWP	0	91	0	0	0	168	24	4,032	4,032	17
Commissioning Generators																	
OSS Commissioning Generators	Generator	Marine Tier 3 Generator	8	500	4,000	Marine Tier 3	N/A	0	0	0	0	0	56	12	672	672	31
WTG Commissioning Generators	Generator	Marine Tier 3 Generator	1	240	240	Marine Tier 3	N/A	0	0	0	0	0	517	12	6,205	6,205	32
Miscellaneous																	
Marine Paint	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fuel Evaporation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Activity	Representative Vessel Type	Engine Type	Load Factor	Fuel Consumption (gal)	Emissions (tons) NOx	VOC	CO	PM10	PM2.5	SO2	Pb	HAPs	H2SO4	CO2	CH4	N2O	CH4 as CO2e	N2O as CO2e	CO2e
Emissions During Construction																			
Foundation Installation (FOU) B02																			
Medium HLV	Heavy Lift Vessel	Main Engine (Transit)	0.83	119,006	22.90	0.32	5.25	0.71	0.69	0.03	0.00	0.05	0.0014	1,477.70	0.01	0.07	0.23	21.10	1,499.02
		Main Engine (Maneuvering)	0.10	1,011,698	194.72	2.72	44.65	6.02	5.82	0.25	0.00	0.42	0.01	12,562.19	0.08	0.60	1.94	179.34	12,743.48
		Auxiliary Engine (Transit)	0.56	4,188	0.79	0.01	0.17	0.02	0.02	0.00	0.00	0.00	0.00	44.41	0.00	0.00	0.01	0.63	45.05
		Auxiliary Engine (Maneuvering)	0.56	295,532	55.84	0.68	11.99	1.55	1.50	0.03	0.00	0.11	0.00	3,133.88	0.02	0.15	0.48	44.66	3,179.03
Bubble Curtain Support Vessel	Tug	Main Engine (Transit)	0.83	21,278	3.52	0.07	0.85	0.12	0.12	0.01	0.00	0.01	0.00	237.71	0.00	0.01	0.04	3.41	241.16
		Main Engine (Maneuvering)	0.10	495,618	81.89	1.55	19.70	2.84	2.75	0.28	0.00	0.23	0.01	5,537.00	0.03	0.27	0.86	79.47	5,617.33
		Auxiliary Engine (Transit)	0.43	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Maneuvering)	0.43	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barge 1	Barge	Main Engine (Transit)	0.83	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Main Engine (Maneuvering)	0.10	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Transit)	0.43	1,780	0.39	0.00	0.08	0.01	0.01	0.00	0.00	0.00	0.00	20.02	0.00	0.00	0.00	0.29	20.31
		Auxiliary Engine (Maneuvering)	0.43	9,635	2.10	0.02	0.41	0.05	0.05	0.00	0.00	0.00	0.00	108.40	0.00	0.01	0.02	1.54	109.96
Barge 2	Barge	Main Engine (Transit)	0.83	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Main Engine (Maneuvering)	0.10	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Transit)	0.43	1,780	0.39	0.00	0.08	0.01	0.01	0.00	0.00	0.00	0.00	20.02	0.00	0.00	0.00	0.29	20.31
		Auxiliary Engine (Maneuvering)	0.43	9,635	2.10	0.02	0.41	0.05	0.05	0.00	0.00	0.00	0.00	108.40	0.00	0.01	0.02	1.54	109.96
US Towing Tug 1	US Towing Tug	Main Engine (Transit)	0.83	346,970	57.33	1.08	13.79	1.99	1.93	0.20	0.00	0.16	0.01	3,876.31	0.02	0.19	0.60	55.63	3,932.55
		Main Engine (Maneuvering)	0.10	226,294	37.39	0.71	8.99	1.30	1.26	0.13	0.00	0.10	0.01	2,528.14	0.02	0.12	0.39	36.28	2,564.81
		Auxiliary Engine (Transit)	0.43	8,401	1.47	0.02	0.36	0.05	0.05	0.00	0.00	0.00	0.00	94.51	0.00	0.00	0.01	1.35	95.87
		Auxiliary Engine (Maneuvering)	0.43	45,475	7.97	0.11	1.96	0.25	0.24	0.00	0.00	0.02	0.00	511.63	0.00	0.02	0.08	7.29	519.00
US Towing Tug 2	US Towing Tug	Main Engine (Transit)	0.83	346,970	57.33	1.08	13.79	1.99	1.93	0.20	0.00	0.16	0.01	3,876.31	0.02	0.19	0.60	55.63	3,932.55
		Main Engine (Maneuvering)	0.10	226,294	37.39	0.71	8.99	1.30	1.26	0.13	0.00	0.10	0.01	2,528.14	0.02	0.12	0.39	36.28	2,564.81
		Auxiliary Engine (Transit)	0.43	8,401	1.47	0.02	0.36	0.05	0.05	0.00	0.00	0.00	0.00	94.51	0.00	0.00	0.01	1.35	95.87
		Auxiliary Engine (Maneuvering)	0.43	45,475	7.97	0.11	1.96	0.25	0.24	0.00	0.00	0.02	0.00	511.63	0.00	0.02	0.08	7.29	519.00
Crew Transfer / PSO / Noise Monitoring Vessel	Crew Transfer Vessel	Main Engine (Transit)	0.83	22,685	3.60	0.06	0.91	0.12	0.12	0.00	0.00	0.01	0.00	255.21	0.00	0.01	0.04	3.64	258.89
		Main Engine (Maneuvering)	0.10	93,565	14.86	0.23	3.74	0.50	0.49	0.01	0.00	0.04	0.00	1,052.61	0.01	0.05	0.16	15.00	1,067.77
		Auxiliary Engine (Transit)	0.43	304	0.05	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	3.42	0.00	0.00	0.00	0.05	3.47
		Auxiliary Engine (Maneuvering)	0.43	10,405	1.88	0.03	0.45	0.06	0.06	0.00	0.00	0.00	0.00	117.07	0.00	0.01	0.02	1.67	118.75
Bubble Curtain Power	Air Compressor	Air Compressor	1.00	1,340,640	41.38	3.93	72.41	0.52	0.52	0.14	0.00	0.36	0.01	15,301.68	0.62	0.12	15.52	36.99	15,354.19
Hydraulic Hammer Power	Hydraulic Hammer Engine	Hammer Engine	1.00	300,888	29.72	3.68	16.25	0.93	0.93	0.03	0.00	0.03	0.00	3,434.25	0.14	0.03	3.48	8.30	3,446.03
Offshore Substation Installation (OSS)																			
Medium HLV	Heavy Lift Vessel	Main Engine (Transit)	0.83	119,006	22.90	0.32	5.25	0.71	0.69	0.03	0.00	0.05	0.0014	1,477.70	0.01	0.07	0.23	21.10	1,499.02
		Main Engine (Maneuvering)	0.10	61,941	11.92	0.17	2.73	0.37	0.36	0.02	0.00	0.03	0.0007	769.11	0.00	0.04	0.12	10.98	780.21
		Auxiliary Engine (Transit)	0.56	4,188	0.79	0.01	0.17	0.02	0.02	0.00	0.00	0.00	0.0000	44.41	0.00	0.00	0.01	0.63	45.05
		Auxiliary Engine (Maneuvering)	0.56	18,094	3.42	0.04	0.73	0.09	0.09	0.00	0.00	0.01	0.0001	191.87	0.00	0.01	0.03	2.73	194.63
	Bubble Curtain Support Vessel	Main Engine (Transit)	0.83	21,278	3.52	0.07	0.85	0.12	0.12	0.01	0.00	0.01	0.0006	237.71	0.00	0.01	0.04	3.41	241.16
		Main Engine (Maneuvering)	0.10	30,344	5.01	0.09	1.21	0.17	0.17	0.02	0.00	0.01	0.0008	339.00	0.00	0.02	0.05	4.87	343.92
		Auxiliary Engine (Transit)	0.43	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Maneuvering)	0.43	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
Transport Barge 1	Barge	Main Engine (Transit)	0.83	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Main Engine (Maneuvering)	0.10	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Transit)	0.43	150	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	1.68	0.00	0.00	0.00	0.02	1.71
		Auxiliary Engine (Maneuvering)	0.43	328	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	3.69	0.00	0.00	0.00	0.05	3.74
Transport Barge 2	Barge	Main Engine (Transit)	0.83	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Main Engine (Maneuvering)	0.10	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Transit)	0.43	150	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	1.68	0.00	0.00	0.00	0.02	1.71
		Auxiliary Engine (Maneuvering)	0.43	328	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	3.69	0.00	0.00	0.00	0.05	3.74
Transport Barge 3	Barge	Main Engine (Transit)	0.83	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Main Engine (Maneuvering)	0.10	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Transit)	0.43	150	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	1.68	0.00	0.00	0.00	0.02	1.71
		Auxiliary Engine (Maneuvering)	0.43	328	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	3.69	0.00	0.00	0.00	0.05	3.74
Transport Barge 4	Barge	Main Engine (Transit)	0.83	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Main Engine (Maneuvering)	0.10	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
		Auxiliary Engine (Transit)	0.43	150	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	1.68	0.00	0.00	0.00	0.02	1.71
		Auxiliary Engine (Maneuvering)	0.43	328	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	3.69	0.00	0.00	0.00	0.05	3.74
US Towing Tug 1	US Towing Tug	Main Engine (Transit)	0.83	29,145	4.82	0.09	1.16	0.17	0.16	0.02	0.00	0.01	0.0008	325.61	0.00	0.02	0.05	4.67	330.33
		Main Engine (Maneuvering)	0.10	7,697	1.27	0.02	0.31	0.04	0.04	0.00	0.00	0.00	0.0002	85.99	0.00	0.00	0.01	1.23	87.24
		Auxiliary Engine (Transit)	0.43	706	0.12	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.0000	7.94	0.00	0.00	0.00	0.11	8.05
		Auxiliary Engine (Maneuvering)	0.43	1,547	0.27	0.00	0.07	0.01	0.01	0.00	0.00	0.00	0.0000	17.40	0.00	0.00	0.00	0.25	17.65

construction, operation, and maintenance methods may change as the Projects incorporate industry advancements. A figure depicting the location of the Projects is provided in Figure 1-1.

1.2 Application Applicability

While the WTGs will not generate air emissions, air emissions will occur in connection with construction and operations and maintenance (O&M). Under 40 CFR Part 55, EPA regulates the air emissions associated with "OCS sources." OCS sources are defined in part as equipment that can emit air pollutants, including air emissions sources on vessels "[p]ermanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom . . ." (40 CFR §55.2). The Projects will require an OCS Air Permit under 40 CFR Part 55 for any regulated OCS sources associated with the Projects.

1.3 Air Emissions Sources

Air emissions from the Projects will be almost exclusively associated with fuel combustion in internal combustion engines.

As described in the September 1, 2022, application, it is important to note that vessel and equipment specifications may change during development and construction of the Projects. Vessel availability at the time of construction or O&M cannot be foreseen with any certainty, given the rapidly changing nature of the offshore wind industry and limitations on vessel use associated with the Jones Act. Vessel data will remain highly speculative throughout the permitting of the Projects. Vessel selection will not be refined until much closer to the start of construction, and vessels may be changed out even after construction begins.

Therefore, Atlantic Shores uses currently best-available information on representative vessel types, with typical or fleet-average emission rates. The number, type, size, and emission rates of vessels could be higher or lower than modeled for any individual activity. Overall, the use of the maximum design scenario associated with the Projects' PDE will serve to ensure a reasonably conservative estimate of emission rates and impacts from the Projects. Appendix A provides a table with the current design information, consistent with what is used for the emissions calculations and model inputs.

4.2.3 Source Configuration for Short Term Air Dispersion Modeling During O&M

This includes the service operation vessel (SOV), crew transfer vessel (CTV), and SOV daughter craft visiting four different positions during the daytime, dropping off personnel and materials to perform routine activities. The SOV is modeled as a "stationary" source with downwash for the time spent at each of the four locations. The CTV and SOV daughter craft are modeled as line-volume sources during daytime operation to address their movement between positions. At night, the SOV daughter craft will be brought on-board the SOV and have no emissions. The SOV and CTV are "parked" away from any structures at night, keeping within one general area while minimizing fuel use. This is represented by an area source between the four positions.

The 24-hour impacts are modeled using the different locations each vessel will be at over the course of a day. When comparing against 1-hour NO_2 standards, emission rates are scaled based on the number of hours the source will operate at any of the four locations. Figure 4-5 shows the source configuration for O&M.

Modeling of short-term O&M impacts two scenarios: the first scenario represents the expected daily O&M activities and a second scenario includes simultaneous heavy repairs. The heavy repairs included in the second scenario are simultaneous IAC repair and major turbine repair (using a US-flagged jackup vessel). The position of O&M activities will vary day to day, and over the course of a single day, throughout the 413 square kilometer Wind Turbine Area (WTA). The revised and updated modeling analysis places the O&M activities at logical locations near the center of the WTA.

Modeling against short-term standards includes transiting vessels. The vessels modeled as transiting are those not already being modeled as maneuvering within the Wind Development Area, that might reasonably be transiting to or from port during the same time period.

4.2.4 Source Configuration for Annual Air Dispersion Modeling During O&M

For O&M, 200 WTG positions and 4 OSS will be visited over the course of a year. The source configuration uses the annualized emission rate for each of the O&M activities occurring at a WTG or OSS location. Source parameters for the vessel at each of these locations are taken based on an average of the vessels emitting at that location during O&M. For transit impacts vessels are grouped based on their port of origin and modeled as line volume sources. As some O&M occurs along the export cable, a line volume source represents O&M emissions occurring near the OECC.

Figure 4-6 shows the location of the 200 WTG positions and 4 OSS positions modeled. Figure 4-6 also shows the locations of the line volume sources.

Activity Type	Vessel	Engine	Engine Category	Engine Count	Activity	Each Engine Size (kW)	Load Factor	Fuel Consumption (gal/hr)	Heat Input (MMBtu/hr)	Exhaust Temp (F)	Exhaust Temp (K)	Stack Height above ocean (m)	Exhaust Flow (wscfm)	Exhaust Flow (wacfm)	Exhaust Diameter (ft)	Exhaust Diameter (m)	Area (ft2)	Stack Velocity (ft/s)	Stack Velocity (m/s)	Stack Angle	Operating Hours / Day
Foundation Installation (FOU) - B02																					
Medium HLV	Heavy Lift Vessel	Main Engines 1	3 Main	4	Transit	3,840	0.83	183.09	25.63	590	583	39.0	8,083	16,073	1.64	0.50	2.11	126.75	38.63	45	24
Medium HLV	Heavy Lift Vessel	Main Engines 1	3 Main	4	Maneuvering	3,840	0.10	22.06	3.09	590	583	39.0	974	1,937	1.64	0.50	2.11	15.27	4.65	45	24
Medium HLV	Heavy Lift Vessel	Main Engines 2	3 Main	2	Transit	4,800	0.83	228.86	32.04	539	555	45.0	10,103	19,116	1.51	0.46	1.79	178.10	54.29	45	24
Medium HLV	Heavy Lift Vessel	Main Engines 2	3 Main	2	Maneuvering	4,800	0.10	27.57	3.86	539	555	45.0	1,217	2,303	1.51	0.46	1.79	21.46	6.54	45	24
Medium HLV	Heavy Lift Vessel	Auxiliary Engine	3 Auxiliary	1	Transit	1,110	0.56	41.88	5.86	816	709	38.0	1,849	4,468	0.98	0.30	0.76	97.88	29.83	45	24
Medium HLV	Heavy Lift Vessel	Auxiliary Engine	3 Auxiliary	1	Maneuvering	1,110	0.56	41.88	5.86	816	709	38.0	1,849	4,468	0.98	0.30	0.76	97.88	29.83	45	24
Bubble Curtain Support Vessel	Tug	Main Engine	1&2 main	2	Transit	5,530	0.83	291.50	40.81	666	625	32.0	12,869	27,443	2.0	0.61	3.14	145.59	44.38	45	24
Bubble Curtain Support Vessel	Tug	Main Engine	1&2 main	2	Maneuvering	5,530	0.10	35.12	4.92	666	625	32.0	1,550	3,306	2.0	0.61	3.14	17.54	5.35	45	24
Barge 1	Barge	Auxiliary Engine	1&2 Auxiliary	1	Transit	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 1	Barge	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 2	Barge	Auxiliary Engine	1&2 Auxiliary	1	Transit	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 2	Barge	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Towing Tug 1	Tug	Main Engine	1&2 main	2	Transit	2,525	0.83	133.10	18.63	860	733	6.0	5,876	14,689	2.0	0.61	3.14	77.93	23.75	45	24
Towing Tug 1	Tug	Main Engine	1&2 main	2	Maneuvering	2,525	0.10	16.04	2.24	860	733	6.0	708	1,770	2.0	0.61	3.14	9.39	2.86	45	24
Towing Tug 1	Tug	Auxiliary Engine	1&2 Auxiliary	3	Transit	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 1	Tug	Auxiliary Engine	1&2 Auxiliary	3	Maneuvering	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 2	Tug	Main Engine	1&2 main	2	Transit	2,525	0.83	133.10	18.63	860	733	6.0	5,876	14,689	2.0	0.61	3.14	77.93	23.75	45	24
Towing Tug 2	Tug	Main Engine	1&2 main	2	Maneuvering	2,525	0.10	16.04	2.24	860	733	6.0	708	1,770	2.0	0.61	3.14	9.39	2.86	45	24
Towing Tug 2	Tug	Auxiliary Engine	1&2 Auxiliary	3	Transit	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 2	Tug	Auxiliary Engine	1&2 Auxiliary	3	Maneuvering	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Crew Transfer / PSO / Noise Monitoring Vessel	Crew Transfer Vessel	Main Engine	1&2 main	4	Transit	522	0.83	27.52	3.85	539	555	6.0	1,215	2,298	1	0.30	0.79	48.77	14.87	Vertical	24
Crew Transfer / PSO / Noise Monitoring Vessel	Crew Transfer Vessel	Main Engine	1&2 main	4	Maneuvering	522	0.10	3.32	0.46	539	555	6.0	146	277	1	0.30	0.79	5.88	1.79	Vertical	24
Crew Transfer / PSO / Noise Monitoring Vessel	Crew Transfer Vessel	Auxiliary Engine	1&2 Auxiliary	2	Transit	27	0.43	0.74	0.10	539	555	6.0	33	62	0.2	0.06	0.03	32.67	9.96	Vertical	24
Crew Transfer / PSO / Noise Monitoring Vessel	Crew Transfer Vessel	Auxiliary Engine	1&2 Auxiliary	2	Maneuvering	27	0.43	0.74	0.10	539	555	6.0	33	62	0.2	0.06	0.03	32.67	9.96	Vertical	24
Bubble Curtain Power	Air Compressor	Air Compressor	Tier 3 Non-Road	20	Maneuvering	399	1.00	28.50	3.99	940	778	10.5	1,450	3,845	0.50	0.15	0.20	326.37	99.48	Vertical	8
Hydraulic Hammer Power	Hydraulic Hammer Engine	Hammer Engine	Tier 2 Non-Road	3	Maneuvering	597	1.00	42.64	5.97	900	755	6.0	1,883	4,849	0.67	0.20	0.35	231.52	70.57	Vertical	8
Offshore Substation Installation (OSS)																					
Medium HLV	Heavy Lift Vessel	Main Engines 1	3 Main	4	Transit	3,840	0.83	183.09	25.63	590	583	39.0	8,083	16,073	1.64	0.50	2.11	126.75	38.63	45	24
Medium HLV	Heavy Lift Vessel	Main Engines 1	3 Main	4	Maneuvering	3,840	0.10	22.06	3.09	590	583	39.0	974	1,937	1.64	0.50	2.11	15.27	4.65	45	24
Medium HLV	Heavy Lift Vessel	Main Engines 2	3 Main	2	Transit	4,800	0.83	228.86	32.04	539	555	45.0	10,103	19,116	1.51	0.46	1.79	178.10	54.29	45	24
Medium HLV	Heavy Lift Vessel	Main Engines 2	3 Main	2	Maneuvering	4,800	0.10	27.57	3.86	539	555	45.0	1,217	2,303	1.51	0.46	1.79	21.46	6.54	45	24
Medium HLV	Heavy Lift Vessel	Auxiliary Engine	3 Auxiliary	1	Transit	1,110	0.56	41.88	5.86	816	709	38.0	1,849	4,468	0.98	0.30	0.76	97.88	29.83	45	24
Medium HLV	Heavy Lift Vessel	Auxiliary Engine	3 Auxiliary	1	Maneuvering	1,110	0.56	41.88	5.86	816	709	38.0	1,849	4,468	0.98	0.30	0.76	97.88	29.83	45	24
Bubble Curtain Support Vessel	Tug	Main Engine	1&2 main	2	Transit	5,530	0.83	291.50	40.81	666	625	32.0	12,869	27,443	2.00	0.61	3.14	145.59	44.38	45	24
Bubble Curtain Support Vessel	Tug	Main Engine	1&2 main	2	Maneuvering	5,530	0.10	35.12	4.92	666	625	32.0	1,550	3,306	2.00	0.61	3.14	17.54	5.35	45	24
Barge 1	Barge	Auxiliary Engine	1&2 Auxiliary	1	Transit	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 1	Barge	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 2	Barge	Auxiliary Engine	1&2 Auxiliary	1	Transit	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 2	Barge	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 3	Barge	Auxiliary Engine	1&2 Auxiliary	1	Transit	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 3	Barge	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 4	Barge	Auxiliary Engine	1&2 Auxiliary	1	Transit	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Barge 4	Barge	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	50	0.43	1.37	0.19	797	698	3.0	60	144	0.50	0.15	0.20	12.18	3.71	Vertical	24
Towing Tug 1	Tug	Main Engine	1&2 main	2	Transit	2,525	0.83	133.10	18.63	860	733	6.0	5,876	14,689	2.0	0.61	3.14	77.93	23.75	45	24
Towing Tug 1	Tug	Main Engine	1&2 main	2	Maneuvering	2,525	0.10	16.04	2.24	860	733	6.0	708	1,770	2.0	0.61	3.14	9.39	2.86	45	24
Towing Tug 1	Tug	Auxiliary Engine	1&2 Auxiliary	3	Transit	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 1	Tug	Auxiliary Engine	1&2 Auxiliary	3	Maneuvering	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 2	Tug	Main Engine	1&2 main	2	Transit	2,525	0.83	133.10	18.63	860	733	6.0	5,876	14,689	2.0	0.61	3.14	77.93	23.75	45	24
Towing Tug 2	Tug	Main Engine	1&2 main	2	Maneuvering	2,525	0.10	16.04	2.24	860	733	6.0	708	1,770	2.0	0.61	3.14	9.39	2.86	45	24
Towing Tug 2	Tug	Auxiliary Engine	1&2 Auxiliary	3	Transit	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 2	Tug	Auxiliary Engine	1&2 Auxiliary	3	Maneuvering	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 3	Tug	Main Engine	1&2 main	2	Transit	2,525	0.83	133.10	18.63	860	733	6.0	5,876	14,689	2.0	0.61	3.14	77.93	23.75	45	24
Towing Tug 3	Tug	Main Engine	1&2 main	2	Maneuvering	2,525	0.10	16.04	2.24	860	733	6.0	708	1,770	2.0	0.61	3.14	9.39	2.86	45	24
Towing Tug 3	Tug	Auxiliary Engine	1&2 Auxiliary	3	Transit	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 3	Tug	Auxiliary Engine	1&2 Auxiliary	3	Maneuvering	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 4	Tug	Main Engine	1&2 main	2	Transit	2,525	0.83	133.10	18.63	860	733	6.0	5,876	14,689	2.0	0.61	3.14	77.93	23.75	45	24
Towing Tug 4	Tug	Main Engine	1&2 main	2	Maneuvering	2,525	0.10	16.04	2.24	860	733	6.0	708	1,770	2.0	0.61	3.14	9.39	2.86	45	24
Towing Tug 4	Tug	Auxiliary Engine	1&2 Auxiliary	3	Transit	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Towing Tug 4	Tug	Auxiliary Engine	1&2 Auxiliary	3	Maneuvering	79	0.43	2.15	0.30	797	698	6.0	95	226	0.50	0.15	0.20	19.17	5.84	45	24
Crew Transfer	Crew Transfer Vessel	Main Engine	1&2 main	4	Transit	522	0.83	27.52	3.85	539	555	6.0	1,215	2,298	1	0.30	0.79	48.77	14.87	Vertical	24
Crew Transfer	Crew Transfer Vessel	Main Engine	1&2 main	4	Maneuvering	522	0.10	3.32	0.46	539	555	6.0	146	277	1	0.30	0.79	5.88	1.79	Vertical	24
Crew Transfer	Crew Transfer Vessel	Auxiliary Engine	1&2 Auxiliary	2	Transit	27	0.43	0.74	0.10	539	555	6.0	33	62	0.2	0.06	0.03	32.67	9.96	Vertical	24

Activity Type	Vessel	Engine	Engine Category	Engine Count	Activity	Each Engine Size (kW)	Load Factor	Fuel Consumption (gal/hr)	Heat Input (MMBtu/hr)	Exhaust Temp (F)	Exhaust Temp (K)	Stack Height above ocean (m)	Exhaust Flow (wscfm)	Exhaust Flow (wacfm)	Exhaust Diameter (ft)	Exhaust Diameter (m)	Area (ft2)	Stack Velocity (ft/s)	Stack Velocity (m/s)	Stack Angle	Operating Hours / Day
Crew Transfer	Crew Transfer Vessel	Auxiliary Engine	1&2 Auxiliary	2	Maneuvering	27	0.43	0.74	0.10	539	555	6.0	33	62	0.2	0.06	0.03	32.67	9.96	Vertical	24
Bubble Curtain Power	Air Compressor	Air Compressor	Tier 3 Non-Road	20	Maneuvering	399	1.00	28.50	3.99	940	778	10.5	1,450	3,845	0.50	0.15	0.20	326.37	99.48	Vertical	10
Hydraulic Hammer Power	Hydraulic Hammer Engine	Hammer Engine	Tier 2 Non-Road	3	Maneuvering	597	1.00	42.64	5.97	900	755	6.0	1,883	4,849	0.67	0.20	0.35	231.52	70.57	Vertical	10
Scour Protection																					
Fall Pipe Vessel	Fall Pipe Vessel	Main Engines 1	1&2 main	4	Transit	3,350	0.83	176.59	24.72	539	555	22.0	7,796	14,750	2.0	0.61	3.14	78.25	23.85	Vertical	24
Fall Pipe Vessel	Fall Pipe Vessel	Main Engines 1	1&2 main	4	Maneuvering	3,350	0.20	42.55	5.96	539	555	22.0	1,878	3,554	2.0	0.61	3.14	18.86	5.75	Vertical	24
Fall Pipe Vessel	Fall Pipe Vessel	Main Engines 2	1&2 main	4	Transit	2,000	0.83	105.42	14.76	539	555	22.0	4,654	8,806	2.0	0.61	3.14	46.72	14.24	Vertical	24
Fall Pipe Vessel	Fall Pipe Vessel	Main Engines 2	1&2 main	4	Maneuvering	2,000	0.20	25.40	3.56	539	555	22.0	1,121	2,122	2.0	0.61	3.14	11.26	3.43	Vertical	24
Fall Pipe Vessel	Fall Pipe Vessel	Auxiliary Engines	1&2 Auxiliary	1	Transit	2,950	0.56	104.92	14.69	539	555	22.0	4,632	8,763	2.0	0.61	3.14	46.49	14.17	Vertical	24
Fall Pipe Vessel	Fall Pipe Vessel	Auxiliary Engines	1&2 Auxiliary	1	Maneuvering	2,950	0.56	104.92	14.69	539	555	22.0	4,632	8,763	2.0	0.61	3.14	46.49	14.17	Vertical	24
Dredging	US Dredger	Main Engine	1&2 main	2	Transit	641	0.83	33.80	4.73	539	555	6.0	1,492	2,824	1.5	0.46	1.77	26.63	8.12	Vertical	24
Dredging	US Dredger	Main Engine	1&2 main	2	Maneuvering	641	0.20	8.15	1.14	539	555	6.0	360	680	1.5	0.46	1.77	6.42	1.96	Vertical	24
Dredging	US Dredger	Auxiliary Engine	1&2 Auxiliary	1	Transit	954	0.56	33.95	4.75	539	555	6.0	1,499	2,835	1.5	0.46	1.77	26.74	8.15	Vertical	24
Dredging	US Dredger	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	954	0.56	33.95	4.75	539	555	6.0	1,499	2,835	1.5	0.46	1.77	26.74	8.15	Vertical	24
Inter Array Cable Installation																					
Cable Installation Vessel	Cable Installation Vessel	Main Engine	1&2 main	1	Transit	7,280	0.83	383.74	53.72	539	555	43.0	16,941	32,053	4.9	1.50	19.02	28.09	8.56	45	24
Cable Installation Vessel	Cable Installation Vessel	Main Engine	1&2 main	1	Maneuvering	7,280	0.20	92.47	12.95	539	555	43.0	4,082	7,724	4.9	1.50	19.02	6.77	2.06	45	24
Cable Installation Vessel	Cable Installation Vessel	Auxiliary Engine	1&2 Auxiliary	1	Transit	220	0.43	6.01	0.84	539	555	43.0	265	502	0.7	0.20	0.35	23.96	7.30	45	24
Cable Installation Vessel	Cable Installation Vessel	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	220	0.43	6.01	0.84	539	555	43.0	265	502	0.7	0.20	0.35	23.96	7.30	45	24
Cable Installation Support Activities	Support Vessel/SOV	Main Engine	1&2 main	4	Transit	1,200	0.16	12.19	1.71	539	555	6.0	538	1,019	1.5	0.46	1.77	9.61	2.93	Vertical	24
Cable Installation Support Activities	Support Vessel/SOV	Main Engine	1&2 main	4	Maneuvering	1,200	0.10	7.94	1.11	539	555	6.0	350	663	1.5	0.46	1.77	6.25	1.91	Vertical	24
Cable Installation Support Activities	Support Vessel/SOV	Auxiliary Engine	1&2 Auxiliary	1	Transit	800	0.16	8.13	1.14	539	555	6.0	359	679	1.5	0.46	1.77	6.40	1.95	Vertical	24
Cable Installation Support Activities	Support Vessel/SOV	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	800	0.10	5.29	0.74	539	555	6.0	234	442	1.5	0.46	1.77	4.17	1.27	Vertical	24
Sand Wave Clearance	TSHD (Dredger)	Main Engine	1&2 main	2	Transit	641	0.83	33.80	4.73	539	555	6.0	1,492	2,824	1.5	0.46	1.77	26.63	8.12	Vertical	24
Sand Wave Clearance	TSHD (Dredger)	Main Engine	1&2 main	2	Maneuvering	641	0.20	8.15	1.14	539	555	6.0	360	680	1.5	0.46	1.77	6.42	1.96	Vertical	24
Sand Wave Clearance	TSHD (Dredger)	Auxiliary Engine	1&2 Auxiliary	1	Transit	954	0.56	33.95	4.75	539	555	6.0	1,499	2,835	1.5	0.46	1.77	26.74	8.15	Vertical	24
Sand Wave Clearance	TSHD (Dredger)	Auxiliary Engine	1&2 Auxiliary	1	Maneuvering	954	0.56	33.95	4.75	539	555	6.0	1,499	2,835	1.5	0.46	1.77	26.74	8.15	Vertical	24
Pre Lay Grapnel Run AHTS 1	AHTS	Main Engine	1&2 main	2	Transit	4,500	0.83	237.20	33.21	860	733	6.0	10,472	26,180	3.28	1.00	8.45	51.61	15.73	Vertical	24
Pre Lay Grapnel Run AHTS 1	AHTS	Main Engine	1&2 main	2	Maneuvering	4,500	0.20	57.16	8.00	860	733	6.0	2,523	6,308	3.28	1.00	8.45	12.44	3.79	Vertical	24
Pre Lay Grapnel Run AHTS 1	AHTS	Auxiliary Engine	1&2 Auxiliary	2	Transit	410	0.43	11.20	1.57	797	698	6.0	494	1,177	0.50	0.15	0.20	99.89	30.45	Vertical	24
Pre Lay Grapnel Run AHTS 1	AHTS	Auxiliary Engine	1&2 Auxiliary	2	Maneuvering	410	0.43	11.20	1.57	797	698	6.0	494	1,177	0.50	0.15	0.20	99.89	30.45	Vertical	24
Pre Lay Grapnel Run AHTS 2	AHTS	Main Engine	1&2 main	2	Transit	4,500	0.83	237.20	33.21	860	733	6.0	10,472	26,180	3.28	1.00	8.45	51.61	15.73	Vertical	24
Pre Lay Grapnel Run AHTS 2	AHTS	Main Engine	1&2 main	2	Maneuvering	4,500	0.20	57.16	8.00	860	733	6.0	2,523	6,308	3.28	1.00	8.45	12.44	3.79	Vertical	24
Pre Lay Grapnel Run AHTS 2	AHTS	Auxiliary Engine	1&2 Auxiliary	2	Transit	410	0.43	11.20	1.57	797	698	6.0	494	1,177	0.50	0.15	0.20	99.89	30.45	Vertical	24
Pre Lay Grapnel Run AHTS 2	AHTS	Auxiliary Engine	1&2 Auxiliary	2	Maneuvering	410	0.43	11.20	1.57	797	698	6.0	494	1,177	0.50	0.15	0.20	99.89	30.45	Vertical	24
Post-Install Rock Protection	Fall Pipe Vessel	Main Engines 1	1&2 main	4	Transit	3,350	0.83	176.59	24.72	539	555	22.0	7,796	14,750	2.0	0.61	3.14	78.25	23.85	Vertical	24
Post-Install Rock Protection	Fall Pipe Vessel	Main Engines 1	1&2 main	4	Maneuvering	3,350	0.20	42.55	5.96	539	555	22.0	1,878	3,554	2.0	0.61	3.14	18.86	5.75	Vertical	24
Post-Install Rock Protection	Fall Pipe Vessel	Main Engines 2	1&2 main	4	Transit	2,000	0.83	105.42	14.76	539	555	22.0	4,654	8,806	2.0	0.61	3.14	46.72	14.24	Vertical	24
Post-Install Rock Protection	Fall Pipe Vessel	Main Engines 2	1&2 main	4	Maneuvering	2,000	0.20	25.40	3.56	539	555	22.0	1,121	2,122	2.0	0.61	3.14	11.26	3.43	Vertical	24
Post-Install Rock Protection	Fall Pipe Vessel	Auxiliary Engines	1&2 Auxiliary	1	Transit	2,950	0.56	104.92	14.69	539	555	22.0	4,632	8,763	2.0	0.61	3.14	46.49	14.17	Vertical	24
Post-Install Rock Protection	Fall Pipe Vessel	Auxiliary Engines	1&2 Auxiliary	1	Maneuvering	2,950	0.56	104.92	14.69	539	555	22.0	4,632	8,763	2.0	0.61	3.14	46.49	14.17	Vertical	24
WTG Installation																					
WTG Installation Vessel	Jackup Vessel	Main Engines 1	3 Main	4	Transit	3,535	0.83	168.54	23.60	539	555	65.0	7,441	14,078	2.63	0.80	5.41	43.36	13.21	45	24
WTG Installation Vessel	Jackup Vessel	Main Engines 1	3 Main	4	Maneuvering	3,535	0.20	40.61	5.69	539	555	65.0	1,793	3,392	2.63	0.80	5.41	10.45	3.18	45	24
WTG Installation Vessel	Jackup Vessel	Main Engines 2	3 Main	3	Transit	2,650	0.83	126.35	17.69	539	555	65.0	5,578	10,554	2.63	0.80	5.41	32.50	9.91	45	24
WTG Installation Vessel	Jackup Vessel	Main Engines 2	3 Main	3	Maneuvering	2,650	0.20	30.45	4.26	539	555	65.0	1,344	2,543	2.63	0.80	5.41	7.83	2.39	45	24
WTG Installation Vessel	Jackup Vessel	Auxiliary Engines	3 Auxiliary	1	Transit	2,650	0.43	76.78	10.75	539	555	65.0	3,390	6,413	2.63	0.80	5.41	19.75	6.02	45	24
WTG Installation Vessel	Jackup Vessel	Auxiliary Engines	3 Auxiliary	1	Maneuvering	2,650	0.43	76.78	10.75	539	555	65.0	3,390	6,413	2.63	0.80	5.41	19.75	6.02	45	24
US Jack Up Feeder 1	Jackup Vessel	Main Engine	3 Main	2	Transit	2,500	0.83	119.20	16.69	539	555	65.0	5,262	9,956	2.63	0.80	5.41	30.66	9.35	45	24
US Jack Up Feeder 1	Jackup Vessel	Main Engine	3 Main	2	Maneuvering	2,500	0.20	28.72	4.02	539	555	65.0	1,268	2,399	2.63	0.80	5.41	7.39	2.25	45	24
US Jack Up Feeder 1	Jackup Vessel	Auxiliary Engine	3 Auxiliary	1	Transit	2,500	0.43	72.43	10.14	539	555	65.0	3,198	6,050	2.63	0.80	5.41	18.63	5.68	45	24
US Jack Up Feeder 1	Jackup Vessel	Auxiliary Engine	3 Auxiliary	1	Maneuvering	2,500	0.43	72.43	10.14	539	555	65.0	3,198	6,050	2.63	0.80	5.41	18.63	5.68	45	24
US Jack Up Feeder 2	Jackup Vessel	Main Engine	3 Main	2	Transit	2,500	0.83	119.20	16.69	539	555	65.0	5,262	9,956	2.63	0.80	5.41	30.66	9.35	45	24
US Jack Up Feeder 2	Jackup Vessel	Main Engine	3 Main	2	Maneuvering	2,500	0.20	28.72	4.02	539	555	65.0	1,268	2,399	2.63	0.80	5.41	7.39	2.25	45	24
US Jack Up Feeder 2	Jackup Vessel	Auxiliary Engine	3 Auxiliary	1	Transit	2,500	0.43	72.43	10.14	539	555	65.0	3,198	6,050	2.63	0.80	5.41	18.63	5.68	45	24
US Jack Up Feeder 2	Jackup Vessel	Auxiliary Engine	3 Auxiliary	1	Maneuvering	2,500	0.43	72.43	10.14	539	555	65.0	3,198	6,050	2.63	0.80	5.41	18.63	5.68	45	24
Crew Transfer Vessel	Crew Transfer Vessel	Main Engine	1&2 main	4	Transit	522	0.83	27.52	3.85	539	555	6.0	1,215	2,298	1.00	0.30	0.79	48.77	14.87	Vertical	24
Crew Transfer Vessel	Crew Transfer Vessel	Main Engine	1&2 main	4	Maneuvering	522	0.20	6.63	0.93	539	555	6.0	293	554	1.00	0.30	0.79	11.75	3.58	Vertical	24
Crew Transfer Vessel	Crew Transfer Vessel	Auxiliary Engine	1&2 Auxiliary	2	Transit	27	0.43	0.74	0.10	539	555	6.0	33	62	0.20	0.06	0.03	32.67	9.96	Vertical	24
Crew Transfer Vessel	Crew Transfer Vessel	Auxiliary Engine	1&2 Auxiliary	2	Maneuvering	27	0.43	0.74	0.10	539	555	6.0	33	62	0.20	0.06	0.03	32.67	9.96	Vertical	24

Source Type	Source ID	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exhaust Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	Volume Source Configuration	Line Volume Height (m)	Line Volume Width (m)	Peak Hour NOx (g/s)	Peak Hour PM2.5 (g/s)	Peak Hour SO2 (g/s)	Peak Hour PM10 (g/s)	Peak Hour CO (g/s)	Peak Hour Elemental Carbon (g/s)	Peak Hour Organic Carbon (g/s)	Peak Hour H2SO4 (g/s)
Point	HLVME11	Heavy Lift Vessel	Main Engines 1	39	1.00	4.65	45.00	3.29	583	N/A	N/A	N/A	4.28	0.128	0.0055	0.13	0.98	3.44E-03	4.63E-02	2.55E-04
Point	HLVME22	Heavy Lift Vessel	Main Engines 2	45	0.65	6.54	45.00	4.62	555	N/A	N/A	N/A	2.67	0.080	0.0035	0.08	0.61	2.15E-03	2.89E-02	1.59E-04
Point	HLVAE1	Heavy Lift Vessel	Auxiliary Engine	38	0.30	29.83	45.00	21.10	709	N/A	N/A	N/A	1.99	0.054	0.0010	0.06	0.43	1.44E-03	1.93E-02	4.76E-05
Point	BBSCME1	Bubble Curtain Support	Engines	32	0.86	5.35	45.00	3.78	625	N/A	N/A	N/A	2.92	0.098	0.0101	0.10	0.70	2.64E-03	3.55E-02	4.66E-04
Line Volume	BARGEA	Barge	Auxiliary Engine	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	3	35	0.08	0.002	0.0000	0.00	0.01	4.97E-05	6.69E-04	1.65E-06
Line Volume	TUGA	Tug	Engines	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	6	15	1.62	0.054	0.0048	0.06	0.39	1.44E-03	1.94E-02	2.20E-04
Line Volume	CTVLINE	Crew Transfer Vessel	Engines	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	6	10	0.60	0.019	0.0004	0.02	0.15	5.21E-04	7.02E-03	1.78E-05
Point	COMP1	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP2	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP3	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP4	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP5	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP6	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP7	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP8	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP9	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP10	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP11	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP12	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP13	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP14	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP15	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP16	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP17	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP18	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP19	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	COMP20	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	HAMMER1	Hydraulic Hammer Engine	Hammer Engine	6	0.35	70.57	Vertical	70.57	755	N/A	N/A	N/A	3.18	0.100	0.0034	0.10	1.74	2.59E-03	3.48E-02	1.55E-04

Source Type	Source ID	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	Volume Source Configuration	Line Volume Height (m)	Line Volume Width (m)	Peak Hour NOx (g/s)	Peak Hour PM2.5 (g/s)	Peak Hour SO2 (g/s)	Peak Hour PM10 (g/s)	Peak Hour CO (g/s)	Peak Hour Elemental Carbon (g/s)	Peak Hour Organic Carbon (g/s)	Peak Hour H2SO4 (g/s)
Point	ESPIVME1	Heavy Lift Vessel	Main Engines 1	39	1.00	4.65	45.00	3.29	583	N/A	N/A	N/A	4.28	0.128	0.0055	0.13	0.98	3.44E-03	4.63E-02	2.55E-04
Point	ESPIVME2	Heavy Lift Vessel	Main Engines 2	45	0.65	6.54	45.00	4.62	555	N/A	N/A	N/A	2.67	0.080	0.0035	0.08	0.61	2.15E-03	2.89E-02	1.59E-04
Point	ESPAE1	Heavy Lift Vessel	Auxiliary Engine	38	0.30	29.83	45.00	21.10	709	N/A	N/A	N/A	1.99	0.054	0.0010	0.06	0.43	1.44E-03	1.93E-02	4.76E-05
Point	OSSBCSV	Bubble Curtain Support	Engines	32	0.86	5.35	45.00	3.78	625	N/A	N/A	N/A	2.92	0.098	0.0101	0.10	0.70	2.64E-03	3.55E-02	4.66E-04
Line Volume	OSSBARGE	Barge	Auxiliary Engine	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	3	35	0.15	0.004	0.000072	0.0038	0.030	9.94E-05	1.34E-03	3.29E-06
Line Volume	OSSTUG	Tug	Engines	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	6	15	3.24	0.11	0.01	0.11	0.78	2.88E-03	3.87E-02	4.41E-04
Line Volume	OSSCTV	Crew Transfer Vessel	Engines	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	6	10	0.60	0.019	0.0004	0.02	0.15	5.21E-04	7.02E-03	1.78E-05
Point	OSSC1	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC2	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC3	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC4	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC5	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC6	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC7	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC8	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC9	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC10	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC11	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC12	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC13	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC14	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC15	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC16	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC17	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC18	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC19	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	OSSC20	Air Compressor	Air Compressor	10.5	0.15	99.48	Vertical	99.48	778	N/A	N/A	N/A	0.22	0.0028	0.0008	0.00	0.39	7.20E-05	9.70E-04	3.46E-05
Point	HAMMER2	Hydraulic Hammer Engine	Hammer Engine	6	0.35	70.57	Vertical	70.57	755	N/A	N/A	N/A	3.18	0.100	0.0034	0.10	1.74	2.59E-03	3.48E-02	1.55E-04

Source Type	Source ID	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	Volume Source Configuration	Line Volume Height (m)	Line Volume Width (m)	Peak Hour NOx (g/s)	Peak Hour PM2.5 (g/s)	Peak Hour SO2 (g/s)	Peak Hour PM10 (g/s)	Peak Hour CO (g/s)	Peak Hour Elemental Carbon (g/s)	Peak Hour Organic Carbon (g/s)	Peak Hour H2SO4 (g/s)
Point	SRFPV	Fall Pipe Vessel	Engines	22	1.83	5.65	Vertical	5.65	555	N/A	N/A	N/A	15.8	0.53	0.10	0.55	3.75	1.43E-02	1.93E-01	4.77E-03
Point	DSCOUR	US Dredger	Main Engine 1	6	0.46	1.96	Vertical	1.96	555	N/A	N/A	N/A	0.34	0.01	0.00	0.01	0.08	3.33E-04	4.49E-03	1.83E-04
Point	DSCOUR2	US Dredger	Main Engine 2	6	0.46	1.96	Vertical	1.96	555	N/A	N/A	N/A	0.34	0.01	0.00	0.01	0.08	3.33E-04	4.49E-03	1.83E-04
Point	DSCOURA1	US Dredger	Auxiliary Engine	6	0.46	8.15	Vertical	8.15	555	N/A	N/A	N/A	1.46	0.05	0.00	0.05	0.37	1.24E-03	1.66E-02	4.09E-05

Source Type	Source ID	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	Volume Source Configuration	Line Volume Height (m)	Line Volume Width (m)	Peak Hour NOx (g/s)	Peak Hour PM2.5 (g/s)	Peak Hour SO2 (g/s)	Peak Hour PM10 (g/s)	Peak Hour CO (g/s)	Peak Hour Elemental Carbon (g/s)	Peak Hour Organic Carbon (g/s)	Peak Hour H2SO4 (g/s)
Line Volume	IAC_SUPT	Cable Installation Support	Engines	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	6	16	1.55	0.053	0.0119	0.05	0.36	1.42E-03	1.91E-02	5.49E-04
Point	CIVME	Cable Installation Vessel	Main Engines	43	1.50	2.06	45.00	1.46	555	N/A	N/A	N/A	3.84	0.133	0.0344	0.14	0.89	3.58E-03	4.81E-02	1.58E-03
Point	CIVAE	Cable Installation Vessel	Auxiliary Engines	43	0.20	7.30	45.00	5.16	555	N/A	N/A	N/A	0.26	0.01	0.0002	0.01	0.07	2.19E-04	2.94E-03	7.24E-06

Source Type	Source ID	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	Volume Source Configuration	Line Volume Height (m)	Line Volume Width (m)	Peak Hour NOx (g/s)	Peak Hour PM2.5 (g/s)	Peak Hour SO2 (g/s)	Peak Hour PM10 (g/s)	Peak Hour CO (g/s)	Peak Hour Elemental Carbon (g/s)	Peak Hour Organic Carbon (g/s)	Peak Hour H2SO4 (g/s)
Point	SWCME	Sand Wave Clearance	Main Engine	6	0.65	1.96	Vertical	1.96	555	N/A	N/A	N/A	0.68	0.024	0.0080	0.03	0.15	6.67E-04	8.98E-03	3.67E-04
Point	SWCAE	Sand Wave Clearance	Auxiliary Engine	6	0.46	8.15	Vertical	8.15	555	N/A	N/A	N/A	1.46	0.046	0.0009	0.05	0.37	1.24E-03	1.66E-02	4.09E-05
Point	PGR1ME	Pre Lay Grapnel Run AHTS 1	Main Engine	6	1.41	3.79	Vertical	3.79	733	N/A	N/A	N/A	4.76	0.160	0.0165	0.17	1.15	4.29E-03	5.78E-02	7.58E-04
Point	PGR1AE	Pre Lay Grapnel Run AHTS 1	Auxiliary Engine	6	0.22	30.45	Vertical	30.45	698	N/A	N/A	N/A	0.99	0.030	0.0006	0.03	0.24	8.15E-04	1.10E-02	2.70E-05
Point	PGR2ME	Pre Lay Grapnel Run AHTS 2	Main Engine	6	1.41	3.79	Vertical	3.79	733	N/A	N/A	N/A	4.76	0.160	0.0165	0.17	1.15	4.29E-03	5.78E-02	7.58E-04
Point	PGR2AE	Pre Lay Grapnel Run AHTS 2	Auxiliary Engine	6	0.22	30.45	Vertical	30.45	698	N/A	N/A	N/A	0.99	0.030	0.0006	0.03	0.24	8.15E-04	1.10E-02	2.70E-05

Source Type	Source ID	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	Volume Source Configuration	Line Volume Height (m)	Line Volume Width (m)	Peak Hour NOx (g/s)	Peak Hour PM2.5 (g/s)	Peak Hour SO2 (g/s)	Peak Hour PM10 (g/s)	Peak Hour CO (g/s)	Peak Hour Elemental Carbon (g/s)	Peak Hour Organic Carbon (g/s)	Peak Hour H2SO4 (g/s)
Point	FPVIAC	Fall Pipe Vessel	Engines	22	1.83	5.65	Vertical	5.65	555	N/A	N/A	N/A	15.8	0.53	0.10	0.55	3.75	1.43E-02	1.93E-01	4.77E-03

Source Type	Source ID	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	Volume Source Configuration	Line Volume Height (m)	Line Volume Width (m)	Peak Hour NOx (g/s)	Peak Hour PM2.5 (g/s)	Peak Hour SO2 (g/s)	Peak Hour PM10 (g/s)	Peak Hour CO (g/s)	Peak Hour Elemental Carbon (g/s)	Peak Hour Organic Carbon (g/s)	Peak Hour H2SO4 (g/s)
Point	WGIVME11	Jackup Installation Vessel	Main Engines 1-1	65	0.80	3.18	45.00	2.25	555	N/A	N/A	N/A	1.97	0.06	0.00	0.06	0.45	1.58E-03	2.13E-02	1.17E-04
Point	WGIVME12	Jackup Installation Vessel	Main Engines 1-2	65	0.80	3.18	45.00	2.25	555	N/A	N/A	N/A	1.97	0.06	0.00	0.06	0.45	1.58E-03	2.13E-02	1.17E-04
Point	WGIVME13	Jackup Installation Vessel	Main Engines 1-3	65	0.80	3.18	45.00	2.25	555	N/A	N/A	N/A	1.97	0.06	0.00	0.06	0.45	1.58E-03	2.13E-02	1.17E-04
Point	WGIVME14	Jackup Installation Vessel	Main Engines 1-4	65	0.80	3.18	45.00	2.25	555	N/A	N/A	N/A	1.97	0.06	0.00	0.06	0.45	1.58E-03	2.13E-02	1.17E-04
Point	WGIVME21	Jackup Installation Vessel	Main Engines 2-1	65	0.80	2.39	45.00	1.69	555	N/A	N/A	N/A	1.48	0.04	0.00	0.05	0.34	1.19E-03	1.60E-02	8.79E-05
Point	WGIVME22	Jackup Installation Vessel	Main Engines 2-2	65	0.80	2.39	45.00	1.69	555	N/A	N/A	N/A	1.48	0.04	0.00	0.05	0.34	1.19E-03	1.60E-02	8.79E-05
Point	WGIVME23	Jackup Installation Vessel	Main Engines 2-3	65	0.80	2.39	45.00	1.69	555	N/A	N/A	N/A	1.48	0.04	0.00	0.05	0.34	1.19E-03	1.60E-02	8.79E-05
Point	WGIVAE1	Jackup Installation Vessel	Auxiliary Engine	65	0.80	6.02	45.00	4.26	555	N/A	N/A	N/A	3.66	0.10	0.00	0.10	0.78	2.63E-03	3.55E-02	8.72E-05
Point	WGFD1ME1	Jackup Feeder	Main Engine	65	0.80	2.25	45.00	1.59	555	N/A	N/A	N/A	1.39	0.04	0.00	0.04	0.32	1.12E-03	1.51E-02	8.29E-05
Point	WGFD1ME2	Jackup Feeder	Main Engine	65	0.80	2.25	45.00	1.59	555	N/A	N/A	N/A	1.39	0.04	0.00	0.04	0.32	1.12E-03	1.51E-02	8.29E-05
Point	WGFD1AE1	Jackup Feeder	Auxiliary Engine	65	0.80	5.68	45.00	4.02	555	N/A	N/A	N/A	3.45	0.09	0.00	0.10	0.74	2.48E-03	3.34E-02	8.23E-05
Line Volume	CTVLINE2	Crew Transfer Vessel	Engines	N/A	N/A	N/A	N/A	N/A	N/A	Separated2W	6	10	1.13	0.037	0.0007	0.04	0.28	9.89E-04	1.33E-02	3.37E-05

Appendix C Class I Air Quality Related Values Analysis

APPENDIX C AIR QUALITY RELATED VALUES

For portions of the Projects subject to Prevention of Significant Deterioration (PSD) review, air quality dispersion modeling is needed to assess impacts to Air Quality Related Values (AQRV), including visibility, per 40 CFR § 52.21(p). This separate modeling analysis has been prepared relating to AQRV, for review in conjunction with the appropriate Federal Land Managers (FLMs).

Per National Park Service guidance: "Under the CAA, the Federal Land Manager (FLM) and the Federal official with direct responsibility for management of Federal Class I parks and wilderness areas have an affirmative responsibility to protect the AQRVs (including visibility) of such lands, and to consider whether a proposed major emitting facility will have an adverse impact on such values" (NPS 2010, the "FLAG Guidance"). The FLM for the Brigantine Wildlife Refuge is the United States Fish and Wildlife Service (USFWS).

Summary of Modeling Analyses

Based on consultations with USFWS, the following technical modeling analyses are attached.

VISCREEN: The attached document "Atlantic Shores Offshore Wind Plume Blight Visibility Analysis" uses the steady-state, gaussian-based plume dispersion VISCREEN (EPA, 1992) for Level I and Level II analyses following the FLAG Guidance visibility assessment procedure for steady-state nearfield conditions. Three operating conditions are analyzed: Construction, normal Operation & Maintenance (O&M), and O&M including simultaneous Heavy Repair activities. The Level II VISCREEN results do not exceed the Delta E and contrast screening values for O&M and O&M with simultaneous Heavy Repair activities. The Plume Delta E exceeds screening criteria for sky background for the Construction case. Per the 1992 VISCREEN User's Guide "if screening demonstrates that criteria are exceeded, plume visual impacts cannot be ruled out, and more detailed plume visual impact analysis to ascertain the magnitude, frequency, location, and timing of plume visual impacts would be required."

CALPUFF Visibility: The same attached report "Atlantic Shores Offshore Wind Class I Air Quality Related Values Modeling Report" provides the more detailed plume visual impact analyses, ascertaining the magnitude, frequency, location, and timing of plume visual impacts for the Construction case. It also repeats the visibility analyses for O&M and O&M including simultaneous Heavy Repair activities, and finds that impacts are below the visibility threshold of concern for those activities.

CALPUFF Deposition: The same attached report "Atlantic Shores Offshore Wind Class I Air Quality Related Values Modeling Report" documents that nitrogen and sulfur annual impacts construction and annual O&M (which includes heavy repair activities) are below the Deposition Analysis Threshold (DAT) per the FLAG Guidance and that no further analysis is required.

Conservatism

For several reasons, the modeling analyses presented here reflect overly-conservative predictions of impacts and provide results that are not directly comparable to previous analyses of other onshore and offshore projects. As examples:

- Modeling includes emissions that would not be addressed for onshore sources.
    - As described throughout the OCS permit application, 40 CFR Part 55 regulates air emissions associated with OCS sources, defined in part as equipment that can emit air pollutants on structures and vessels "permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom" (40 CFR §55.2). Unlike onshore sources, when comparing project potential emissions to regulatory thresholds, the emissions from vessels servicing an OCS source are included when at the OCS source or enroute to or from the OCS source within 25 nautical miles (nm) of the OCS source.
- Modeling includes emissions that would not be addressed for other offshore sources.
    - In BOEM-regulated offshore areas, emission sources which "are conducted in one location for less than three years" are considered temporary (30 CFR 550.302). So, for example, oil and gas construction activities in the Gulf of Mexico would not be subject to air quality dispersion modeling requirements.
- Modeling assumes vessels are stationary for entire 3-year modeling period. O&M activities are modeled as taking place at the project centroid, while construction emissions are modeled at the closest Offshore Substation to shore.
    - (OCS application section 5.1) Vessels will be in motion while operating, so emissions from vessels will not come from a fixed point in space. The Atlantic Shores modeling does not address the effect of waves on stack heights and angles (which would generally serve to increase dispersion). During both construction and O&M, vessel emissions will only exist for a few hours or days at any one location, before moving to the next location. Modeling the sources as stationary is likely to overstate impacts.
    - (OCS application section 5.4.2) Construction activities will happen only once per location. For O&M, the vessel's position will not be the same visit to visit. Some inspections will not involve disembarking at the WTG or OSS; the vessel will instead slowly circumnavigate the WTG or OSS while crew visually inspect for damage or wear. When crew are disembarking from SOVs the vessel will approach from different directions depending on the wind and waves. The SOV will typically use a gangway for transfer of crew. After transfer of crew, the vessel will then back away from the WTG or OSS and station nearby while the crew is working. Again, the vessel will station itself at a different location each time depending on the wind and waves, so emissions will not be occurring at a single point as modeled.

- Modeling assumes intermittent operations occur continuously.
    - As mentioned in Atlantic Shores' response to comments submitted October 28, 2022, the chances that the emissions are occurring at the same time as the worst-case weather conditions are very small, and we do believe it is important to distinguish between a model's prediction that an impact will occur during some weather conditions, and a model's prediction that an impact could occur in the unlikely event that emissions coincide with unfavorable weather conditions. Overall, the levels of conservatism applied by taking an intermittent source and assuming continuous operation are beyond what was envisioned during the development of the relevant standards.
- Modeling assumes discrete, separate operations occur simultaneously and in close proximity.
    - As described in Section 5.4.1 of the OCS permit application, the entire construction operation covers over 200 positions and will take more than a year to complete. The operations with substantial emissions each take 40 hours or less to complete. Unless specifically scheduled to occur near each other, the chances of operations with substantial emissions occurring in nearby positions is very low. Atlantic Shores has no intention of scheduling major construction operations near each other. For safety and logistics reasons, Atlantic Shores will avoid having large groups of vessels operating near one another. For this analysis, however, activities were modeled as occurring as near to each other as possible while maintaining safety standards.
    - Similarly, during O&M, the chances that routine maintenance will be happening near a significant repair, when spread across over 200 positions and when each activity takes only a few hours, is very low. In the O&M heavy repair case, for example, the modeled 365 days of jackup vessel operation are a conservative estimate, with actual jackup operations expected to be between 35 and 80 hours per year. Interarray cable repairs are expected to be fewer than 18 days per year. As in the construction case, O&M activities were modeled as occurring as near to each other as possible while maintaining safety standards. Analyzing impacts based on an extremely unlikely confluence of events imparts a level of conservatism beyond what was envisioned with the establishment of the relevant standards and thresholds.
- Modeling does not account for seasonal restrictions on vessel operations.
    - As mentioned in Section 8.2.3 of Atlantic Shore's COP Volume II, offshore construction will not take place between January and April during each year of the construction phase for marine wildlife protection. In this report, offshore construction activity emissions are modeled as occurring year-round over three full years of meteorological data. This adds to conservatism by assuming that meteorological conditions which occur during the restricted quarter of each construction year have the potential to coincide with construction emissions.

Air Quality Benefits

Atlantic Shores would also like to emphasize that the development of offshore wind energy infrastructure aligns with several Pollution Prevention Strategies as listed in the Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report – Revised (2010). The November 28, 2023 proposed addendum to the FLAG Phase 1 Report acknowledges that "in some project development scenarios, short-lived emission increases may be necessary to fulfill the development of an overall low emitting project," using offshore wind energy construction as an example.

In its September 1, 2022 OCS application (Section 3.9.3), Atlantic Shores presented emissions reductions resulting from the projecting using EPA's Emissions & Generation Resource Integrated Database (eGRID2018) Avoided Emission Factors for the RFC East region. Table 1 lists the details that were used to calculate the project's annual power generation, while Table 2 uses eGRID2018 factors to calculate avoided emissions based on generated power. Though it is not yet known which exact onshore emission sources will be displaced by the project, which makes it impossible to model the impacts of displacement on the BNWR AQRVs specifically, the avoided emissions calculation demonstrates the project's potential to prevent air pollution in New Jersey at large.

Table 1 Calculated Annual Power Generation

	Project 1	Project 2
Total Capacity (MW)	1,510	960*
Capacity Factor	50%	50%
Transmission Loss Factor	4.0%	4.0%
Hours per Year	8,760	8,760
Annual Power Generated (MW-hr)	6,349,248	4,036,608

*After submittal of the OCS application, from which this data is excerpted, it was determined that Project 2's target capacity is 1327 MW. The resulting avoided emissions of Project 2 are therefore underestimated in this calculation.

Table 2 Calculated Avoided Emissions

Pollutant	Avoided Emissions Factor (lb/MWh)	Operating Term (years)	Total Annual Emissions Displacement (ton/yr)	Total Emissions Displacement (tons)
NOx	0.681	30	**3,536**	**106,092**
SO2	0.803	30	**4,170**	**125,098**
CO2e	1,248.615	30	**6,483,968**	**194,519,034**
PM	0.048	30	**250**	**7,497**

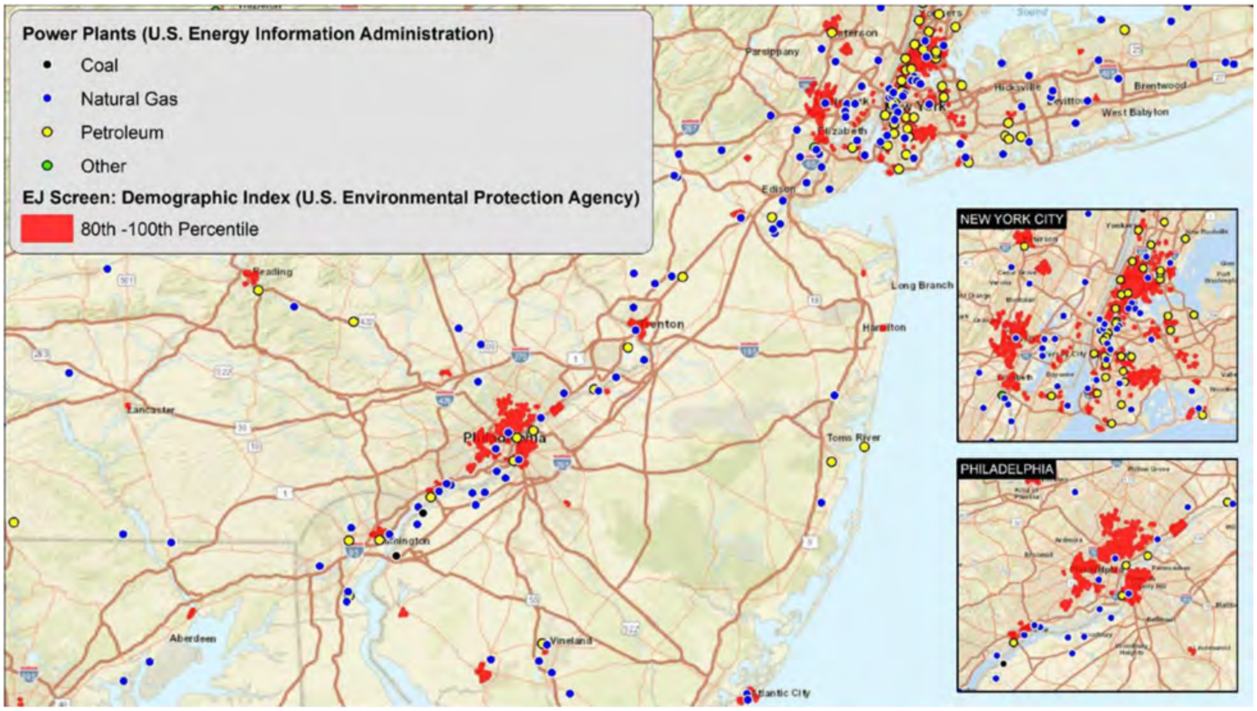
While outside the technical scope of this analysis, it is reasonable to conclude that the emissions reductions realized by the operation of the Atlantic Shores project will reduce ambient air concentrations of pollutants of concern and improve overall visibility conditions at BNWR.

As further contextual considerations, existing fossil fuel generators tend to be located in or near Environmental Justice populations, and displacing the operations of those generators by Atlantic Shores will provide direct, localized air quality improvements in those Environmental Justice populations.

Figure 1 provides a regional map showing the location of existing fossil fuel electrical generators and Environmental Justice populations. Again while outside the scope of this analysis, others have predicted substantial health and climate benefits from New Jersey offshore wind projects. For example, the Harvard School of Public Health has stated that offshore wind facilities located off the coast of New Jersey and Maryland could have health and climate benefits worth over half a billion dollars per year, and could save over 50 lives per year[1].

[1] https://www.hsph.harvard.edu/c-change/news/health-and-climate-benefits-of-offshore-wind/

Figure 1 **Locations of Existing Fossil Fuel Electrical Generators and Environmental Justice Populations**



Additional Emission Avoidance & Mitigation

As part of the air permit application process, Atlantic Shores will document that subject emission units meet Lowest Achievable Emission Rate (LAER), Best Available Control Technology (BACT), and State Of The Art (SOTA) requirements. Atlantic Shores will also purchase Certified Emission Reductions (CERs), banked with NJDEP, to offset the project's entire O&M potential-to-emit NOx and VOC. These are federally enforceable, rate-based shutdown credits generated by facilities in New Jersey. The purchase and retirement of CERs, specifically NOx, from the sources identified will help offset the potential impact from the proposed project. The CERs are expected to be from utility sources of air emission generally upwind of BNWR. The emissions from these sources are typically from elevated point sources with substantial buoyancy and vertical momentum that has the potential to inject these emissions into the boundary layer and travel substantial distances, and the cessation of these emissions is likely to create an improvement to AQRV at BNWR.

The Atlantic Shores project is subject to review under the National Environmental Policy Act (NEPA), with the Bureau of Ocean Energy Management (BOEM) as lead agency. In its Draft Environmental Impact Statement (DEIS) BOEM has documented Atlantic Shores' commitment to implement applicant-proposed environmental protection measures to avoid, minimize, mitigate, and monitor impacts to affected resources. In the FEIS, BOEM may incorporate additional measures, including those that would be appropriate to mitigate potential impacts to AQRVs such as visibility. Atlantic Shores has already examined, as part of its OCS air permit application, the use of cleaner control technologies that may be feasible for offshore wind project construction, operation, and maintenance. Additional measures may also be considered through consultations, authorizations, and permits under other environmental statutes, such as the CAA. If determined to be required to mitigate impacts, these measures will be incorporated into the FEIS. After publication of the FEIS, BOEM will issue a Record of Decision stating the agency's decision and requirements for mitigation and monitoring and adopt those measures as conditions of COP approval (40 CFR 1505.3). Atlantic Shores will be required to certify compliance with these conditions under 30 CFR 285.633(b).

Through both the NEPA and the OCS air permit processes, Atlantic Shores will commit to avoiding, minimizing, and mitigating air emissions impacts to the extent feasible. This will include the selection of the lowest-emitting vessels and operations within the logistical and supply chain constraints of the construction and operation of the wind farm. Many of these commitments cannot be quantified or included in modeling analysis at this time. Atlantic Shores has previously described that, for most or all construction and O&M contracts, the contracts will not be finalized until after the specific Project reaches financial close, which will not occur until after all permits, including the OCS air permit, are issued. To allow the Project to maximize renewable energy production, minimize impacts, and minimize ratepayer costs, Atlantic Shores will carefully manage the rapidly-changing landscape of offshore construction and O&M equipment and personnel availability. Potential impacts of emissions control technologies beyond those already considered in the current assessments cannot be estimated until contracts are finalized.

As contractors retrofit their own vessels and marine engine technologies progress to limit emissions, Atlantic Shores will make reasonable efforts to employ the lowest-emitting vessels available to meet Project needs at the time. To restrict vessel or engine specifications this early in the project could result in additional emissions during the construction or O&M phases by increasing delays if a certain vessel requires maintenance or becomes otherwise unavailable, since there would be fewer eligible vessels to replace it. Delays may increase overall actual emissions by forcing vessels to idle, maneuver inefficiently, take additional trips to port, or operate simultaneously in the closest safe proximity.

Atlantic Shores Offshore Wind

Plume Blight Visibility Analysis

Introduction

A visual impact analysis was conducted to assess construction emission plume impacts on nearby Class I areas and was submitted as part of the September 2022 air permit application for the Atlantic Shores South Projects, which propose to construct, operate, and decommission two offshore wind energy generation projects in Lease Area OCS-A 0499. A supplement VISCREEN analysis was submitted in September 2023. This VISCREEN analysis supplements the September 2023 analysis based on verbal comments received from the United States Fish and Wildlife Service (U.S. FWS) and the United States Environmental Protection Agency (U.S. EPA) Region2, by assessing impacts during Construction, Operation, and Operations and Maintenance (O&M) of the offshore wind farm.

This submittal supplements the visibility analysis required by 40 CFR 52.21 (o). While not directly addressing compliance with requirements under 40 CFR 52.21 (p)(3), this submittal follows available guidance for such analyses for consistency with other projects. Therefore, in accordance with the *Federal Land Manager's Air Quality Related Values Work Group (FLAG) Revised Phase I Report*[1], the VISCREEN model (U.S. EPA, 1992a) was used. The Level I and Level II VISCREEN analyses were completed.

Fine particulates scatter or absorb light while NOx absorbs light, particularly in the blue spectrum of light. VISCREEN takes inputs of particulates and NOx emission rate, geometry of the emission source and receptor, and meteorological conditions to calculate the color difference ΔE and contrast C_p of the plume against a sky or terrain background at three wavelengths in the visible spectrum (0.4, 0.55, and 0.7 µm). If the color difference and contrast parameters calculated in VISCREEN are greater than the screening criterion set by U.S. EPA, then the plume is expected to be visible.

The VISCREEN model offers two forms of analysis - Level I and Level II. The Level I analysis uses conservative assumptions for plume impacts: worst case meteorological criteria of 1 m/s wind speed, very stable atmosphere (Pasquill-Gifford stability class F), and a wind direction that transports the plume directly to the receptor. Limited user-inputs are required in the Level I analysis and default meteorological variables and particulate characteristics may be used. If the Level I result exceeds the screening criteria, a Level II analysis is warranted. A Level II analysis allows the user to input project-specific meteorological data to define the worst-case wind speed, direction, and stability class and particulate diameters, if known.

---

[1] Federal Land Manager's Air Quality Related Values Work Group (FLAG) Revised Phase I Report https://www.fws.gov/guidance/sites/guidance/files/documents/FLAG%20Air%20Quality%20Phase%201%20report.pdf (EPA, 2010)

The analysis reviews impacts at the Brigantine Natural Area, which is representative of onshore impacts. Onshore receptors from the NPS Class I Area Receptor database was used to calculate geometry and the distance to the nearest boundary of the Class I area.[2] Based on discussion with U.S. FWS two different distances were utilized. The first assessed impacts from Operation emissions from the offshore wind farm at the edge of the lease area. A second analysis assessed impacts from Construction and O&M from the centroid of the lease area. Based on discussion with U.S. FWS the worst-case plume centerlines were assumed to be representative of the entire Class I area and were offset by a source-receptor line by 11.25° were drawn to represent the worst-case plume centerlines (see Figure 1). The most distant Class I Boundary receptor that intersected a worst-case plume centerline was chosen as the furthest distance between the source and receptor. To be conservative, the distance to the observer and closest Class I boundary were kept equal. Table 1 below shows the geometries used for the Level I and II analyses.

Table 1 Distances

Scenario	Class I Area	Observation Point[1]	Distance from Receptor to Source (km)	Distance from Closest Class I Boundary to Source (km)	Distance from Furthest Class I Receptor along plume centerline to Source (km)
Construction	Brigantine Natural Area, NJ	Receptor #11 (39.454167, -74.329167)	28.6	28.6	42.4
O&M					
Operations			15.3	15.3	18.8

[2] Class I Area Receptors (NPS). https://irma.nps.gov/DataStore/Reference/Profile/2249830

Figure 1 Atlantic Shores Project Geometry

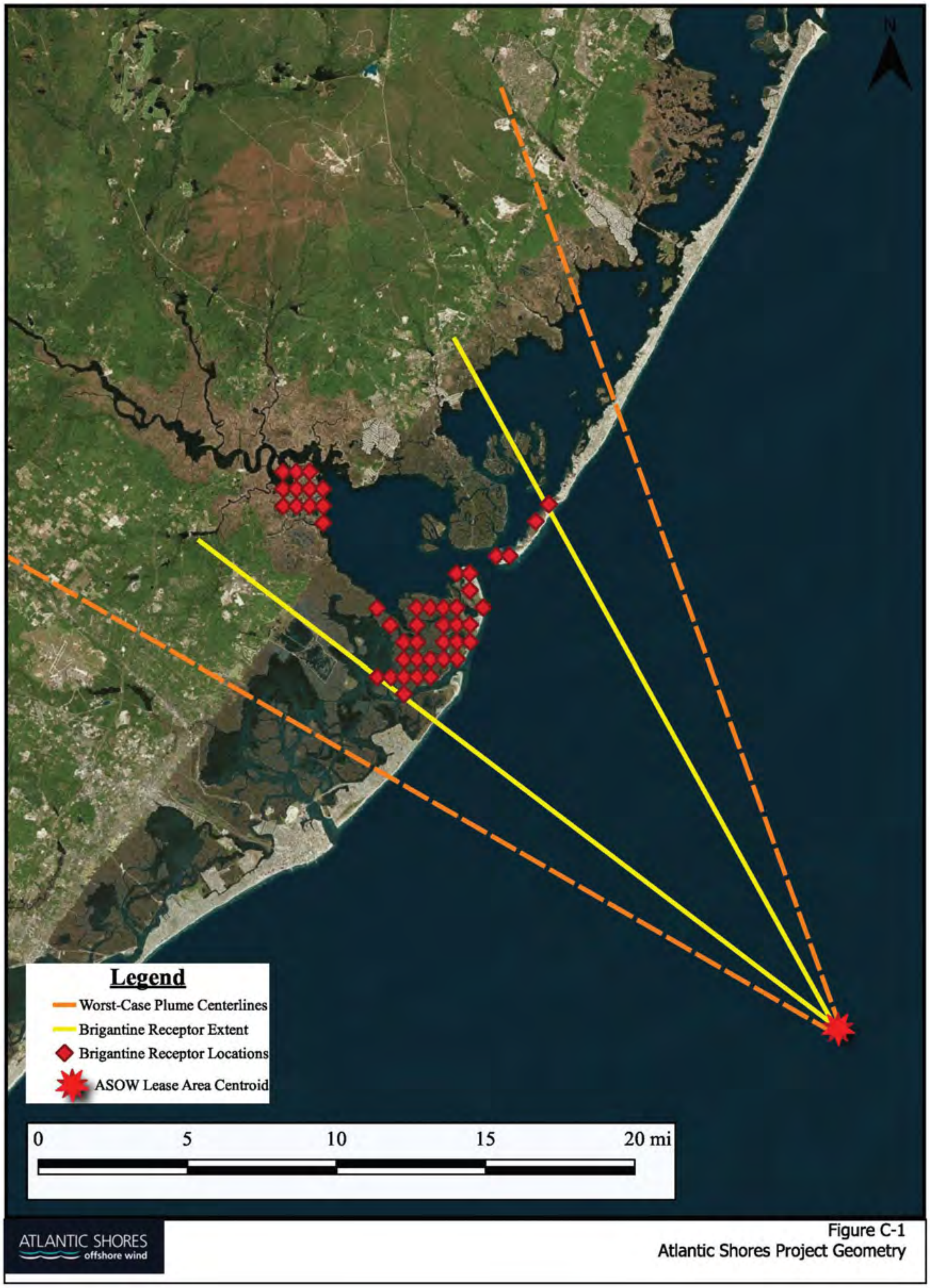


Figure C-1
Atlantic Shores Project Geometry

Methodology

The guidance in the *Workbook for Plume Visual Impact Screening and Analysis (Revised)* was followed for the Level I and Level II analyses (EPA, 1992).[3]

Level I Methods

The user-defined inputs for the Level I analysis are described below. Default values for wind speed (1 m/s), stability class (Class F), and particle attributes were used. Table 2 shows the default particle sizes and densities used in the Level I and II analysis.

Table 2 Default Particle Size and Density Specifications[3]

Particle Type	Mass Median Diameter (µm)	Density (g/cm^3)
Background fine	0.3	1.5
Background coarse	6	2.5
Plume particulate	2	2.5
Plume soot	0.1	2
Plume primary sulfate	0.5	1.5

Background visual range: The background visual range was determined using the monthly average values presented in Table 10 of the *FLM Air Quality Related Values Work Group (FLAG) Phase 1 Report*.[4] The annual average background visual range for Brigantine is 159.2 km.

Emission Rates: The g/s emission rates used in the VISCREEN analysis are the worst-case emissions from Construction and O&M at the centroid of the lease area. The g/s emission rate used in the VISCREEN is the worst-case Operations emissions rate at the nearest WTG to the evaluated area. These emissions represent a conservative estimate since Construction and O&M activities are transient and will happen throughout the entire lease area. Operations emissions assume worst-case emissions occur at the closest point to Brigantine. In all cases these emissions include emissions from transits. Table 3 shows the emission rates used in the Level I and II analysis for each of the Scenarios.

[3] Workbook for plume visual impact screening and analysis (revised). EPA Office of Air Quality Planning and Standards. EPA-454/R-92-023. October 1992.

[4] FLM Air Quality Related Values Work Group (FLAG) Phase 1 Report. https://www.fws.gov/guidance/sites/guidance/files/documents/FLAG%20Air%20Quality%20Phase%201%20report.pdf, p 68. Revised 2010.

Table 3 Emission Rates

Pollutant	Construction (g/s)	Operations (g/s)	O&M (g/s)
Primary Particulate Matter	5.58	0.91	1.54
NOx	179.95	29.21	50.05
Primary NO2	0.00	0.00	0.00
Soot (Elemental Carbon)	0.15	0.02	0.04
Primary Sulfate (SO4)	0.03	0.0021	0.0045

Level I Results

The Level I VISCREEN results for each of the scenarios exceeded the screening criteria at the receptor analyzed. Therefore, a more refined Level II analysis using local meteorology was warranted. Level I analysis results for each scenario are presented in Table 4.[5]

Table 4 Level I VISCREEN Results Inside the Class I Area

Scenario	Background	Theta(a)	Azimuth(b)	Distance (km)(c)	Alpha(d)	Delta E		Contrast	
						Criteria	Plume	Criteria	Plume
Construction	Sky	10	130	35.0	39	2	28.910*	0.05	-0.101*
	Sky	140	130	35.0	39	2	17.547*	0.05	-0.196*
	Terrain	10	84	28.6	84	2	11.943*	0.05	0.082*
	Terrain	140	84	28.6	84	2	6.227*	0.05	0.025
Operations	Sky	10	131	18.8	38	2	9.844*	0.05	-0.025
	Sky	140	131	18.8	38	2	5.975*	0.05	-0.048
	Terrain	10	84	15.3	84	2	3.744*	0.05	0.018
	Terrain	140	84	15.3	84	2	1.306	0.05	0.004
O&M	Sky	10	10	13.7	159	2	15.612*	0.05	-0.060*
	Sky	140	10	13.7	159	2	9.208*	0.05	-0.115*
	Terrain	10	0	1.0	168	2	17.473*	0.05	0.202*
	Terrain	140	0	1.0	168	2	4.650	0.05	0.114*

Notes

* Indicates screening criterion is exceeded.
(a) The angle between the observer and the line of sight in 5° increments.

[5] It should be noted that VISCREEN does not exclude unrealistic geometries of the sun, source, and receptor. Therefore, the Workbook guidance states: "The analyst should review each line of sight, paying particular attention to those for which screening criteria are exceeded, to verify that screening decisions are not based on unrealistic geometries." For example, an azimuth angle of 0° would mean the sun is directly north of Brigantine, an angle that does not occur at this latitude. In Brigantine NWR during the summer solstice, the azimuth angle of the sun ranges from 55.34° at sunrise to 305° degrees at sunset.

(b) The azimuthal angle (in degrees) between the line connecting the source and observer and the line of sight
(c) The downwind distance of the plume from the emission source.
(d) the angle (in degrees) between the line of sight and the plume centerline

Level II Methods

The Level II analysis, as described previously, is conducted if results from the Level I analysis exceed the screening criteria. A Level II analysis mandates the use of at least one year of local meteorological data for an actual worst case wind speed and stability class and particulate size distributions, if known. Based on discussion with the U.S. FWS, the Level II analysis was performed considering daytime (one hour prior to sunrise through one hour before sunset) periods only.

Particle Size Distribution: The Level I default values were used for default size distributions of the pollutants, as there were no data available on project-specific sizes.

Met. Data & Wind Sectors: A joint frequency distribution table for the wind sectors impacting the project was prepared from three years of meteorological data. The closest and furthest receptors modeled in VISCREEN were within 296.4-338.0° from the emission source (see Figure 1). To account for the worst-case plume centerlines, another 11.25° was added on both sides of this range (285.0-350°). Winds that blow from 105-170°, or from the southeast, would transport the plume directly to the sector containing the receptors and cause the worst-case visual impacts.

The three-year (2018-2020) meteorological dataset from the Atlantic City International Airport (ACY) was downloaded from the National Centers for Environmental Information (NCEI)[6]. The dataset was filtered to include only "on-the-hour" observations. The Pasquill-Gifford stability classes were determined using Turner's method as described in the EPA Meteorological Monitoring Guidance for Regulatory Modeling Applications[7] and corresponding wind speeds during each hour were tabulated for the dataset. Turner's method limits Pasquill-Gifford to stability categories of "A", "B", C", or "D" during daytime periods. The dataset was then filtered to include wind directions between 105-170°. Entries were stratified into six-hour blocks as recommended in the Workbook guidance. The product of the Pasquill-Gifford vertical and horizontal dispersion coefficients and the wind speed was used to rank the entries from least to greatest. The results from this analysis appear in Table 5.

[6] https://www.ncei.noaa.gov/cdo-web/

[7] https://www.epa.gov/sites/default/files/2020-10/documents/mmgrma_0.pdf

Table 5 Frequency & Cumulative Frequency for Worst-Case Winds & Stability Classes A, B, C, & D During Daytime Periods

Stability Class, Wind Speed (m/s)	Trans-port Time (Hrs)	Pasquill-Gifford Factors			Frequency of Occurrence of Stability Class & Wind Speed During Receptor Sector Wind Direction (by time of day)					
					Frequency of Occurrence			*Cumulative Frequency*		
		σy[1]	σz[2]	σz*σy*u (m^3/s)	0-5[3] Hrs	6-11 Hrs	12-17[3] Hrs	0-5[3] Hrs	6-11 Hrs	12-17[3] Hrs
4, 1	9	793.00	171.58	1.36E+05	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4, 2	3	793.00	171.58	2.72E+05	39.1%	25.4%	9.2%	39.1%	25.4%	9.2%
4, 3	2	793.00	171.58	4.08E+05	13.0%	15.6%	16.2%	52.2%	41.0%	53.9%
4, 4	1	793.00	171.58	5.44E+05	8.7%	8.9%	16.4%	60.9%	49.8%	41.8%
4, 5	1	793.00	171.58	6.80E+05	17.4%	10.7%	14.7%	78.3%	60.6%	56.5%
4, 6	1	793.00	171.58	8.16E+05	0.0%	13.8%	4.5%	78.3%	74.3%	61.0%
3, 1	9	1195.07	741.16	8.86E+05	4.3%	5.8%	10.2%	82.6%	80.1%	71.2%
4, 7	1	793.00	171.58	9.52E+05	0.0%	1.8%	4.3%	82.6%	82.0%	75.5%
4, 8	1	793.00	171.58	1.09E+06	0.0%	1.5%	2.6%	82.6%	83.5%	78.0%
4, 9	1	793.00	171.58	1.22E+06	0.0%	1.2%	1.1%	82.6%	84.7%	79.1%
4, 10+	< 1	793.00	171.58	1.36E+06	4.3%	1.2%	1.1%	87.0%	85.9%	80.2%
3, 2	3	1195.07	741.16	1.77E+06	4.3%	3.4%	2.8%	91.3%	89.3%	82.9%
3, 3	2	1195.07	741.16	2.66E+06	0.0%	3.7%	2.6%	91.3%	93.0%	85.5%
3, 4	1	1195.07	741.16	3.54E+06	0.0%	2.1%	5.3%	91.3%	95.1%	90.8%

[1] As calculated in Table 7.
[2] As calculated in Table 8.
[3] 0-5 covers the "daytime" portion only, i.e. one-hour prior to sunrise, and one hour prior to sunset.

The Level 2 VISCREEN analysis was run using the D,2 combination of the wind speed and Pasquill-Guifford Stability class for each of the scenarios. Results appear below in Table 6.

The VISCREEN analysis assumes that the emissions are emitted continuously at the same location for an entire year. The emissions in this case are not emitted continuously in one location and instead are spread over all areas of the lease area over the course of the year with Operations and O&M typically occurring for less than 4 days per year (1.1%) in any single location. If an impact does not exceed a threshold of impact at least 1% of the time (3-4 days per year), it is considered to have passed the Level 2 screening and no further analysis is required. Complex Terrain: The project study area was coastal and did not include complex terrain. The change in elevation between the emission source and the nearest onshore receptor was ~3 m.

Level II Results

The Level II VISCREEN results exceed the Delta E screening criteria for sky background at the receptor analyzed for construction. The VISCREEN results do not exceed the Delta E and contrast screening values for Operations and O&M. Results for the Level II analysis for Construction, Operations and O&M are presented in Table 6.

Table 6 Level II VISCREEN Results for Inside the Class I Boundary for Construction

Scenario	Stability Class	Wind Speed (m/s)	Plume Delta E Exceeds Screening Criteria for Sky Background	Plume Delta E Exceeds Screening Criteria for Terrain Background	Plume Contrast Exceeds Screening Criteria for Sky Background	Plume Contrast Exceeds Screening Criteria for Terrain Background
Construction	D	2	YES	NO	NO	NO
Operations	D	2	NO	NO	NO	NO
O&M	D	2	NO	NO	NO	NO

Supplemental Tables

Table 7 Pasquill-Gifford Horizontal Dispersion Coefficient Calculation[8]

PG Class	c	d	TH[1]	σ_y [2]
1	24.167	2.5334	1.738809	2210.52
2	18.333	1.8096	1.328075	1694.90
3	12.5	1.0857	0.917429	1195.76
4	8.333	0.72382	0.611591	793.00
5	6.25	0.54287	0.458713	593.71
6	4.1667	0.36191	0.043634	3.95E+02

Notes:
[1] TH = 0.017453293 *(c - d ln (x))
[2] σ_y = 465.11628 (x)tan(TH)
x = downwind distance, km, or 15.3 km

Table 8 Pasquill-Gifford Vertical Dispersion Coefficient Calculation

PG Class	x (km)[1]	a	b	σ_z [2]
1	> 3.11	**	**	5,000
2	> 0.40	109.300	1.09710	2,179.4
3	ALL	61.141	0.91465	741.2
4	10.01-30.00	36.650	0.56589	171.6
5	10.01-20.00	26.970	0.46713	96.4
6	15.01-30.00	22.651	0.32681	55.2

Notes:
[1]Calculated assuming x = 15.3 km
[2] $\sigma_z = a*x^b$
** σ_z is equal to 5,000 meters.

[8] *Appendix E, Workbook for plume visual impact screening and analysis (revised).* EPA Office of Air Quality Planning and Standards. EPA-454/R-92-023. October 1992.

ATLANTIC SHORES OFFSHORE WIND

Class I Air Quality Related Values Modeling Report

Prepared for:
Epsilon Associates
3 Mill & Main Place, Suite 250
Maynard, MA 01754

Prepared By:
Ramboll Americas Engineering Solutions, Inc.
Boston, Massachusetts

Date:
February 29, 2024

Project Number:
1940104631

RAMBOLL

CONTENTS

Acronyms and Abbreviations

AQRV	air quality related values
BART	Best Available Retrofit Technology
BCKNH3	background ammonia concentration
CM	course mass
DAT	deposition analysis threshold
EPA	United States Environmental Protection Agency
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLM	Federal Land Manager
ha	hectare
HNO_3	nitric acid
IAC	inter-array cable
IWAQM	Interagency Workgroup on Air Quality Modeling
kg	kilogram
LCC	Lambert Conformal Conic
MMIF	Mesoscale Model Interface Program
N	nitrogen
NOx	nitrogen oxides
NO_2	nitrogen dioxide
NO_3	nitrate
NPS	National Park Service
NWR	National Wildlife Refuge
OH	hydroxyl radical
OCS	outer continental shelf
OSS	offshore substation
ppb	parts per billion
PM	particulate matter
S	sulfur
SO_2	sulfur dioxide
SO_4	sulfate
WRF	Weather Research and Forecast Model
yr	year

1 INTRODUCTION

Atlantic Shores Offshore Wind, LLC ("Atlantic Shores") proposes to construct, operate, and decommission two offshore renewable wind energy projects in Lease Area OCS-A 0499 (collectively the "project site" or the "project"). The Lease Area is approximately 183,253 acres (741.6 square kilometers [km^2]) in size and is located on the Outer Continental Shelf (OCS) within the New Jersey Wind Energy Area (NJWEA).

Brigantine National Wildlife Refuge (NWR) ("Brigantine") is located approximately 15 km from the closest point of the Atlantic Shores lease area and is a single Class I area situated within 300 km of the outer boundary of the project site. Air emissions from vessels and other equipment involved in the construction (construction phase) and operations and maintenance (O&M; operation phase) of the wind turbine generators and offshore substations may impact air quality related values (AQRV) at Brigantine. This report describes the procedures used in assessing the impacts on AQRV, namely visibility and deposition, associated with emissions during the construction and operation and maintenance (O&M) phases of the Atlantic Shores Offshore Wind Projects located in Lease Area OCS-A 0499.

This report represents an update to the November 2023 report (Ramboll, 2023), associated with inclusion of two transit line sources (Transit NJWP and Transit Atlantic City) to the 24-hour visibility assessment. The changes compared to the November 2023 report is reflected in emissions tables (Table 1, Table A-3, and Table A-4) and the visibility results tables (Table 4 through Table 7). Figures B-3 and B-4 are also updated. The November 2023 report was a follow up on the previous modeling reports by Exponent (Exponent, 2022) and Ramboll (Ramboll, 2022). It was performed as a response to the information requests regarding the OCS air permit application for the proposed Atlantic Shores. These information requests were provided by the Federal Land Managers (FLM) to the U.S. Environmental Protection Agency (EPA) on August 18, 2023, who provided them to Atlantic Shores on August 21, 2023.

Broadly, three new sets of CALPUFF modeling results are presented:

- Construction Phase, reflecting updates to the project plans and modeling parameters consistent with the revised AERMOD modeling submitted to EPA on June 30, 2023; and
- Operations and Maintenance (O&M) Phase, with two scenarios modeled:
    - Normal O&M, and;
    - Normal O&M coinciding with major repair activities.

Modeling techniques remain generally as-described in the Exponent, 2022 CALPUFF modeling report. The changes in this round of modeling reflect changes to the number, size, location, and emission rates of vessels, and the overlapping operations. The methodology for calculating emission rates is described in the OCS air permit application (Epsilon, 2022), notably Section 2.1 and Section 2.1.1. The modeled emission rates are the projected emissions based on the maximum rated capacity of the equipment and maximum throughput of the facility, calculated based on detailed plans for each activity, load factors, and emission factors. The details of the emissions development for construction and O&M phases are provided in the letter to the FLM (Epsilon, 2023b) and form the basis for this CALPUFF modeling. Short term emissions (maximum 24-hour emission rates) were used for the visibility impact assessment, and the annual emission rates were used for the estimates of annual deposition.

2 MODELING APPROACH

2.1 Model Selection

Modeling to assess the impacts on AQRV in Brigantine was conducted using the CALPUFF non-steady-state air dispersion model. CALPUFF contains a module to compute visibility effects as well as wet and dry deposition fluxes. Computation of visibility effects are based on the impact of particulate matter concentration on light extinction and enhanced by the hydroscopic property of particulate matter (PM).

CALPUFF is recommended for Class I area air quality impact assessments by the Federal Land Managers' AQRV Workgroup (FLAG, 2010) and the Interagency Workgroup on Air Quality Modeling (IWAQM) (EPA, 1998). CALPUFF is also recommended by the EPA as the preferred model for Best Available Retrofit Technology (BART) analyses (Federal Register, July 6, 2005).

The IWAQM developed procedures for evaluating visibility impacts (EPA, 1998) which are referenced in the Federal Land Managers' AQRV Workgroup guidance document on assessing air quality-related values in Class I areas (FLAG, 2010). The procedures focus on the contribution of anthropogenically-generated fine particles such as sulfate and nitrate to visibility degradation. The procedures involve the use of an air quality model to calculate concentrations of PM. The CALPUFF model is recommended for this type of application because of its ability to simulate chemical conversions of SO_2 and NO_x to sulfate and nitrate, respectively, its treatment of wet and dry deposition, and its ability to represent non-steady-state transport over longer range distances when the assumptions of steady-state models break down.

The modeling was conducted in accordance with procedures in the FLAG (2010) guidance document using CALPUFF version 5.8.5. Version 5.8.5 is the most recent regulatory version of CALPUFF approved and recommended by U.S. EPA and Federal Land Managers (FLM). CALPOST regulatory version 6.221 and POSTUTIL version 1.56 were used for postprocessing. This version of CALPOST implements the FLAG (2010) recommendations for visibility modeling.

2.2 Meteorological Data and Modeling Domain

Meteorological data for the modeling were the same as in the 2022 modeling assessment (Exponent, 2022). The three years (2018-2020) of meteorological data were produced by EPA using the Weather Research and Forecast Model (WRF). The WRF output was converted into CALMET format using the Mesoscale Model Interface Program (MMIF) by maintaining the 12-kilometer horizontal grid resolution of the parent WRF simulations, and the CALMET.DAT files were provided by the FLM. Default options in MMIF were used for the calculation of stability class and mixing heights. In the vertical, ten CALMET layers were defined consistent with the default layers specified by EPA/FLM guidance (layer tops of 20, 40, 80, 160, 320, 640, 1200, 2000, 3000 and 4000 meters). The Lambert Conformal Conic (LCC) projection from the original WRF simulation was maintained by MMIF and was further used in the CALPUFF simulations. The LCC parameters include an origin of 40.574 N, 97.0 W, standard parallels of 33 N and 45 N, and NWS-84 datum.

The meteorological data fields supplied by WRF were evaluated by Exponent to ensure they reliably represent conditions within the modeling domain. Model performance was evaluated using wind speed, wind direction, temperature, and specific humidity, comparing the observed meteorological data within the modeling domain to WRF simulations to evaluate whether the simulations provide a sufficiently representative set of meteorological parameters for air dispersion modeling. The meteorological data evaluation is discussed in more detail in a separate report (Exponent, 2022).

The CALPUFF modeling domain is equivalent to the CALMET modeling domain provided by EPA/FLM. It encompasses the project site, the Brigantine Class I area, and a broad buffer beyond them (Figure 1). A large buffer is maintained around the Class I area and the project site allowing for potential recirculation of pollutants. A 12-km grid resolution, consistent with the WRF simulations processed by MMIF, was used in the CALPUFF modeling.

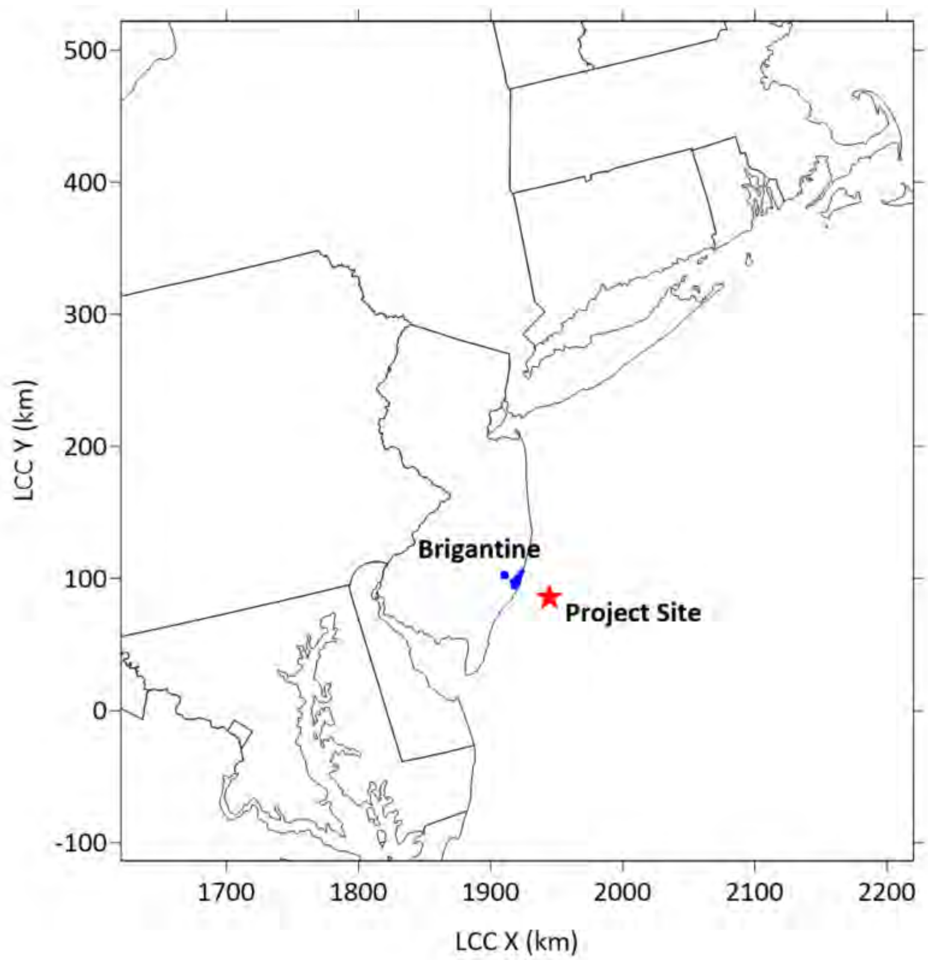


Figure 1. CALPUFF modeling domain including the location of the project site and Brigantine Class I area.

2.3 Receptors

The 46 Class I area receptors obtained from the National Park Service (NPS) data[1] were used in the modeling (Figure 2). The receptor locations (latitude and longitude) and heights were obtained from the National Park Service (NPS) data base. These locations were converted to LCC coordinates for use in CALPUFF consistent with the original WRF projection.

[1] From the NPS web site: https://irma.nps.gov/DataStore/Reference/Profile/2249830

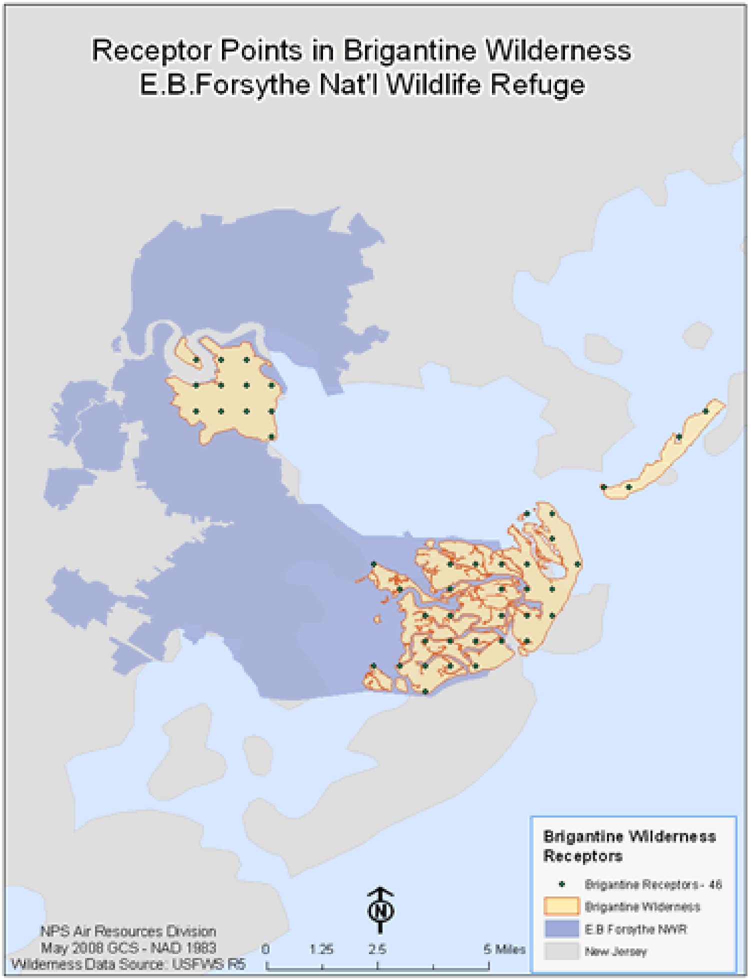


Figure 2. Class I Area receptors for Brigantine Wilderness.

2.4 CALPUFF Configuration

CALPUFF was run in the regulatory mode, MREG =1, and configured with the following model options:

- Gaussian near-field distribution, MGAUSS=1
- Transitional plume rise, MTRANS=1
- Stack tip downwash, MTIP=1
- Pasquill-Gifford (PG) dispersion coefficients (rural areas), McElroy-Pooler (MP) coefficients (urban areas), MDISP=3, with PDF not used for dispersion under convective conditions, MPDF=0
- Transition of σy to time-dependent (Heffter) growth rates with SYTDEP=550. No transition for σz, MHFTSZ= 0

- Without building downwash (due to a large source-receptor distances)
- Partial plume path adjustment for terrain, MPARTL=1
- Chemical transformation using MESOPUFF II, MCHEM=1
- Wet deposition and dry deposition, MWET=1 and MDRY=1

Depositions and chemical transformation effects were modeled using the default dry deposition module, the scavenging coefficient wet removal module, and the default chemical transformation mechanism in the CALPUFF model. Eleven species were modeled with CALPUFF for this analysis: SO_2, SO_4, NO_x, HNO_3, NO_3, and six particulate matter (PM) species corresponding to various size categories. The six PM species named PM056, PM081, PM112, PM187, PM425, and PM800 represent the following size categories, respectively: (0.5–0.625, 0.625–1, 1–1.25, 1.25–2.5, 2.5–6, and 6–10 µm). Of the eleven modeled species, nine were emitted by the project sources: SO_2, SO_4, NO_x and six PM categories. All six PM categories were model with unit emission rate in the CALPUFF model and the appropriate emission scaling to account for emission speciation was done in POSTUTIL for each source separately. The MESOPUFF II was used to compute chemical transformation rates of SO_2 to SO_4 and NO_x to NO_3/HNO_3.

The default background ammonia concentration (BCKNH3) of 10 ppb was used in CALPUFF modeling. POSTUTIL with MNITRATE=1 was used for nitrate repartitioning, as recommended by the FLM.

Hourly surface ozone measured at the Brigantine AQS Site ID 34-001-0006, located at 39.465N, 74.449W, was used in the CALPUFF modeling. These ozone concentrations, along with radiation intensity, were used as surrogates for the hydroxyl radical (OH) concentration during the day, when the gas phase free radical chemistry is active. For a small number of hours when ozone concentrations are missing at this monitor, CALPUFF used monthly background concentration values from the control files. The monthly background ozone concentrations, BCKO3, were defined as a monthly average of daytime (9:00-18:00) monitored ozone concentrations over the 3-year modeling period.

2.5 Deposition

To assess potential deposition impacts on soil and vegetation, modeling of deposition due to the project's emissions was conducted in accordance with IWAQM Phase 2 recommended procedures accepted by FLAG. The deposition of nitrogen (N) and sulfur (S) was predicted in terms of kilograms per hectare per year (kg/ha/yr). The predicted deposition rate for each species is compared to the applicable deposition analysis threshold (DAT) appropriate for eastern areas, 0.010 kg/ha/yr for each species. These nitrogen and sulfur DATs are not adverse impact thresholds, but do represent conservative screening criteria that allow the FLMs to identify potential deposition fluxes requiring further consideration on a case-by-case basis.

2.6 Visibility

The FLAG Method 8 procedure was applied to determine the impacts on visibility within Brigantine. Natural visibility is affected by Rayleigh scattering (scattering of light by air molecules) and by naturally occurring aerosols. Most natural and anthropogenic aerosols that can affect light extinction fall into the following categories: sulfates ($(NH_4)_2SO_4$), nitrates (NH_4NO_3), organic mass (OM), elemental carbon (EC), soil, sea salt, and coarse mass (CM). The recommended FLAG (2010) procedures examine thresholds of visibility degradation as measured in terms of light extinction to evaluate far-field source impacts to haze. Visibility conditions are based on the averaged extinction efficiencies of several individual constituents that comprise total extinction. The analysis used the

CALPOST postprocessor with parameter MVISBK set to 8, which represents a default Method 8 for visibility extinction calculations. For nitrate partitioning, MNITRATE = 1 was used in POSTUTIL with the ammonia background concentration of 1.5 ppb, as recommended by the FLM. This value is appropriate for the area where Brigantine is located. The ammonia limiting method is accepted by the FLM in order to prevent overestimation of nitrate which can occur within CALPUFF when every puff is allowed to independently see the full background ammonia concentration.

In the visibility impact assessment analysis, background extinction coefficients were calculated using annual average natural concentration values for Brigantine (Table 6 of the FLAG guidance). Monthly relative humidity adjustment factors were used to account for hygroscopic effects (Tables 7 through 9 of the FLAG guidance).

Under the FLAG (2010) guidance, the visibility threshold of concern is not exceeded if the 98th percentile change in light extinction is < 5% for each year modeled when compared to the annual average natural conditions value for a particular Class I area. In this study, calculation of the annual 98th percentile (8th highest daily impact per year) maximum 24-hour change in light extinction over clean natural visibility conditions for Brigantine was performed.

3 EMISSION SOURCE DATA

Emission parameters for sources included in the modeling were provided to Ramboll by Epsilon Associates. The source inventory includes vessels and equipment used during construction and O&M of the project. Appendix A (Table A-1 through Table A-4) provides a detailed listing of all sources that comprise each scenario. Description of the sources and emissions calculations are provided in the Air Permit Application prepared by Epsilon (Epsilon, 2023a) and letter from Epsilon to the FLM (Epsilon, 2023b). Locations of sources are presented in Figure B-1 through Figure B-4 of Appendix B. Sources are assumed to have a base elevation of zero meters above sea level. For any source with a non-vertical orientation, only the vertical component of the velocity was used in the modeling. The 24-hour emission rates were used for the visibility impact assessment, and the annual emission rates were used for the estimates of annual deposition. A summary of the emissions rate for all source combined for each operation phase for each pollutant for each analyzed scenario is presented in Table 1.

Table 1. Emission Scenarios Summary.

Emission Temporal Basis	Phase	NO_x (g/s)	$PM_{2.5}$ (g/s)	SO_2 (g/s)	Average PM_{10} (g/s)	Elemental Carbon (g/s)	Organic Carbon (g/s)	H_2SO_4 (g/s)
Annual	Construction	3.29	0.10	0.01	0.10	0.00	0.04	0.0003
Annual	O&M Normal	1.18	0.04	0.00	0.04	0.00	0.01	0.0001
24hr	Construction*	128.58	3.92	0.44	4.04	0.10	1.41	0.0202
24hr	Construction* (3 highest)	75.50	2.14	0.13	2.20	0.06	0.77	0.0061
24hr	O&M Normal*	8.69	0.28	0.03	0.29	0.01	0.10	0.0013
24hr	O&M Normal* and major repairs and IAC repairs	29.53	0.91	0.08	0.94	0.024	0.33	0.0036

*Include Transit NJWP and Transit Atlantic City line source

4 MODEL ANALYSIS RESULTS

4.1 Deposition

Total nitrogen and sulfur depositions were computed for evaluating potential acid deposition impacts from the project due to the annualized emissions during construction and O&M phases. Locations of emissions sources representing construction phase is shown in Figure B-1 and those representing O&M phase in Figure B-2. The annualized emissions are shown in Table A-1 (construction) and Table A-2 (O&M). The predicted deposition rates for each species are compared to the applicable deposition analysis threshold (DAT) appropriate for eastern areas, 0.010 kg/ha/yr for each species. The nitrogen and sulfur DATs are not adverse impact thresholds; but do represent conservative screening criteria which allow the FLMs to identify potential deposition fluxes requiring further consideration on a case-by-case basis. The modeled annual sulfur and nitrogen deposition values for both the construction and O&M phases are below the DAT (Table 2 and Table 3).

Table 2. Deposition Results - Construction

Modeled Year	Maximum Annual N Deposition (kg/ha/yr)	Maximum Annual S Deposition (kg/ha/yr)	N and S Deposition Analysis Threshold (kg/ha/yr)
2018	0.009	0.0002	0.010
2019	0.007	0.0001	
2020	0.007	0.0002	

Table 3. Deposition Results – O&M

Modeled Year	Maximum Annual N Deposition (kg/ha/yr)	Maximum Annual S Deposition (kg/ha/yr)	N and S Deposition Analysis Threshold (kg/ha/yr)
2018	0.003	0.0001	0.010
2019	0.002	0.0001	
2020	0.003	0.0001	

4.2 Visibility

The Transit NJWP and Transit Atlantic City sources are included in all the visibility modelling. The change in light extinction within Brigantine due to primary and secondary PM associated with emissions from the project's construction and O&M were computed using the FLAG Method 8 procedure, using daily emission rates. The 98th percentile (8th highest daily impact per year) maximum 24-hour changes in light extinction over clean natural visibility conditions for Brigantine for each modelled year are presented in Table 4 to Table 7. The number of days when change in light extinction exceeded 5% and 10% are also presented. The modeling results show the number of exceedances if the maximum 24-hr emissions were emitted every day which is a very conservative scenario. For construction, the results are presented when all potentially overlapping sources are emitted at the same time (Table 4) as well as for the scenario with the three highest emitting activities (Table 5). For normal O&M as well as normal O&M occurring simultaneously with major turbine repairs and Inter-Array Cable (IAC) repair, the 5% visibility extinction threshold for the 98th percentile is not exceeded for any of the 3 years (Table 6 and Table 7).

Table 4. Visibility – Construction All Potentially Overlapping Activities*

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	16.4%	33	15	1.52	33	15
2019	11.0%	28	13	1.04	28	10
2020	16.2%	30	15	1.50	30	14

* foundation installation, wind turbine erection, offshore substation (OSS) construction, scour protection, IAC install, IAC pre-lay, and IAC scour protection; also included are the Transit NJWP and Transit Atlantic City. Locations of these sources are shown in Figure B-3.

Table 5. Visibility – Construction Three Highest-Emitting Activities*

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	9.6%	20	6	0.91	18	5
2019	6.8%	15	0	0.65	15	0
2020	10.4%	17	8	0.99	17	7

* foundation installation, wind turbine erection, OSS construction; locations representing these 3 activities are shown in Figure B-3 as Foundation Install, WTG Install and OSS Install. The Transit NJWP and Transit Atlantic City are also included.

Table 6. Visibility – Normal O&M Activities

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	1.5%	0	0	0.14	0	0
2019	1.1%	0	0	0.11	0	0
2020	1.8%	1	0	0.18	1	0

*Locations of these activities are shown in Figure B-4 as Location1 through Location4. The Transit NJWP and Transit Atlantic City are included as well.

Table 7. Visibility – Normal O&M Activities Plus Major Turbine Repair Plus IAC Repair

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	3.5%	3	0	0.35	3	0
2019	3.1%	0	0	0.30	0	0
2020	4.5%	7	2	0.44	7	1

*Locations of these activities are shown in Figure B-4. The Transit NJWP and Transit Atlantic City are included as well.

5 REFERENCES

EPA, 1998. Interagency Workgroup on Air Quality Modeling (IWAQM), Phase 2 Report: Summary Report and Recommendation for Modeling Long Range Transport and Impacts on Regional Visibility. EPA-454/R-98-019.

Epsilon. 2022: Atlantic Shores Offshore Wind, Outer Continental Shelf Air Permit Application.

Epsilon. 2023a: Atlantic Shores Offshore Wind, Outer Continental Shelf Air Permit Application, Air Quality Dispersion Modeling Report. July 2023.

Epsilon. 2023b: Letter to U.S. Fish and Wildlife Service – Subject: Atlantic Shores Offshore Wind LLC – Outer Continental Shelf Air Permit Application. November 10, 2023.

Exponent. 2022: Atlantic Shores Offshore Wind. Class I Air Quality Related Values Modeling Report

FLAG. 2010. Federal Land Managers' Air Quality Related Values Workgroup (FLAG). Phase I Report—Revised 2010. U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service.

Ramboll. 2022: Atlantic Shores Offshore Wind. Modeling Addendum: Refined CALPUFF Class I Nitrogen and Sulfur Deposition Modeling Results. November 2022.

Ramboll. 2023: Atlantic Shores Offshore Wind. Modeling Addendum: Class I Air Quality Related Values Modelling Report. November 2023.

APPENDIX A
EMISSION RATES AND SOURCE PARAMETERS USED IN THE MODELING

Table A-1 Annual Emission Rates and Source Parameters used for deposition modeling – Construction

Activity	Type	Count	Stack Height above ocean (m)	Exhaust Diameter (m)	Vertical Velocity (m/s)	Exit Temp (K)	Annual Average NO_x (g/s)	Annual Average $PM_{2.5}$ (g/s)	Annual Average SO_2 (g/s)	Annual Average PM_{10} (g/s)	Annual Average CO (g/s)	Annual Average Elemental Carbon (g/s)	Annual Average Organic Carbon (g/s)	Annual Average H_2SO_4 (g/s)
WTG	Point	141	22.16	5.12	5.85	667.69	3.08E-01	9.34E-03	7.76E-04	9.63E-03	8.21E-02	2.50E-04	3.37E-03	3.57E-05
OSS	Point	4	13.48	1.78	23.52	751.33	3.63E-01	1.00E-02	6.96E-04	1.03E-02	1.64E-01	2.69E-04	3.62E-03	3.20E-05
			Height above ocean (m)	**SigmaY (m)**	**SigmaZ (m)**									
Transit NJWP	Line Volume *	1	18.21	27.9	4.24		2.24E+00	6.98E-02	4.77E-03	7.20E-02	5.21E-01	1.87E-03	2.52E-02	2.19E-04
Transit Europe	Line Volume *	1	25.73	29.8	5.98		2.42E-01	7.79E-03	1.19E-03	8.04E-03	5.59E-02	2.09E-04	2.81E-03	5.46E-05
Transit Atlantic City	Line Volume *	1	6.00	9.3	1.4		1.39E-01	4.57E-03	9.13E-05	4.72E-03	3.50E-02	1.23E-04	1.65E-03	4.19E-06

*Line source modelled as volume sources

Table A-2 Annual Emission Rates and Source Parameters used for deposition modeling – O&M

Activity	Type	Count	Stack Height above ocean (m)	Exhaust Diameter (m)	Vertical Velocity (m/s)	Exit Temp (K)	Annual Average NO_x (g/s)	Annual Average $PM_{2.5}$ (g/s)	Annual Average SO_2 (g/s)	Annual Average PM_{10} (g/s)	Annual Average CO (g/s)	Annual Average Elemental Carbon (g/s)	Annual Average Organic Carbon (g/s)	Annual Average H_2SO_4 (g/s)
Maintenance	Point	200	32.52	3.28	3.38	555	5.10E-02	1.60E-03	1.51E-04	1.65E-03	1.20E-02	4.28E-05	5.77E-04	6.96E-06
OSS Generators	Point	4	64.00	0.57	44.33	755	3.31E-03	5.54E-05	3.88E-06	5.71E-05	2.85E-03	1.48E-06	2.00E-05	1.78E-07
			Height above ocean (m)	**SigmaY (m)**	**SigmaZ (m)**									
Export Cable	Line Volume *	1	6.00	9.3	1.4		6.09E-02	2.07E-03	4.50E-04	2.13E-03	1.41E-02	5.54E-05	7.46E-04	2.07E-05
Transit NJWP	Line Volume *	1	17.80	13.95	4.14		8.78E-02	2.69E-03	2.68E-04	2.78E-03	2.00E-02	7.23E-05	9.73E-04	1.23E-05
Transit Europe	Line Volume *	1	65.00	55.81	15.12		4.74E-01	1.40E-02	5.75E-04	1.45E-02	1.08E-01	3.76E-04	5.07E-03	2.64E-05
Transit Atlantic City	Line Volume *	1	8.00	9.3	1.86		5.08E-01	1.66E-02	5.91E-04	1.72E-02	1.27E-01	4.47E-04	6.02E-03	2.71E-05

*Line source modelled as volume sources

Table A-3 24h Emission Rates and Source Parameters for visibility modeling – Construction

Activity	Type	Count	Stack Height above ocean (m)	Exhaust Diameter (m)	Exhaust Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exhaust Temp (K)	24 Hour Average NO_x (g/s)	24 Hour Average $PM_{2.5}$ (g/s)	24 Hour Average SO_2 (g/s)	24 Hour Average PM_{10} (g/s)	24 Hour Elemental Carbon (g/s)	24 Hour Organic Carbon (g/s)	24 Hour H2SO4 (g/s)
Foundation Install	Point	1	39	1.00	4.65	45.00	3.29	583	21.78	0.59	0.04	0.60	0.02	0.21	0.002
OSS Install	Point	1	39	1.00	4.65	45.00	3.29	583	23.48	0.65	0.05	0.66	0.02	0.23	0.002
Scour Protection	Point	1	22	1.83	5.65	Vertical	5.65	555	17.97	0.60	0.11	0.62	0.02	0.22	0.005
IAC Install	Point	1	43	1.50	2.06	45.00	1.46	555	5.64	0.19	0.05	0.20	0.01	0.07	0.002
IAC Pre-Lay	Point	1	6	1.41	3.79	Vertical	3.79	733	13.65	0.45	0.04	0.47	0.01	0.16	0.002
IAC Scour	Point	1	22	1.83	5.65	Vertical	5.65	555	15.82	0.53	0.10	0.55	0.01	0.19	0.005
WTG Install	Point	1	65	0.80	3.18	45.00	2.25	555	23.33	0.68	0.02	0.70	0.02	0.25	0.001
			Height above ocean (m)	SigmaY (m)	SigmaZ (m)										
Transit NJWP	Line Volume *	1	13.1	27.9	3.1				6.17E+00	1.98E-01	1.66E-02	2.05E-01	5.32E-03	7.17E-02	7.62E-04
Transit Atlantic City	Line Volume *	1	6.0	9.3	1.4				7.45E-01	2.44E-02	4.88E-04	2.52E-02	6.56E-04	8.83E-03	2.24E-05

*Line source modelled as volume sources

Table A-4 24h Emission Rates and Source Parameters used for visibility modeling – O&M[2]

Activity	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exit Temp (K)	24 Hour Average NO_x (g/s)	24 Hour Average $PM_{2.5}$ (g/s)	24 Hour Average SO_2 (g/s)	24 Hour Average PM_{10} (g/s)	24 Hour Elemental Carbon (g/s)	24 Hour Organic Carbon (g/s)	24 Hour Average H_2SO_4 (g/s)
Routine Location 1	Daughter Craft O&M Position 1	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 1	CTV1 O&M Position 1	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 1	CTV 2 O&M Position 1	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 1	SOV O&M Position 1	Main Engines	16	1.22	2.06	45.00	1.46	555	6.33E-01	2.20E-02	5.67E-03	2.27E-02	5.90E-04	7.94E-03	2.60E-04
Routine Location 1	SOV O&M Position 1	Auxiliary Engines	16	0.91	3.18	45.00	2.25	555	5.72E-01	1.79E-02	3.47E-04	1.85E-02	4.81E-04	6.48E-03	1.59E-05
Routine Location 2	Daughter Craft O&M Position 2	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 2	CTV1 O&M Position 2	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06

[2] Routine Location activities are part of normal operations and the addition activities are major repairs or IAC repair.

Activity	Vessel	Engine	Stack Height above ocean (m)	Exhaust Diameter (m)	Exit Velocity (m/s)	Stack Angle	Vertical Velocity (m/s)	Exit Temp (K)	24 Hour Average NO_x (g/s)	24 Hour Average $PM_{2.5}$ (g/s)	24 Hour Average SO_2 (g/s)	24 Hour Average PM_{10} (g/s)	24 Hour Elemental Carbon (g/s)	24 Hour Organic Carbon (g/s)	24 Hour Average H_2SO_4 (g/s)
Routine Location 2	CTV 2 O&M Position 2	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 2	SOV O&M Position 2	Main Engines	16	1.22	2.06	45.00	1.46	555	6.33E-01	2.20E-02	5.67E-03	2.27E-02	5.90E-04	7.94E-03	2.60E-04
Routine Location 2	SOV O&M Position 2	Auxiliary Engines	16	0.91	3.18	45.00	2.25	555	5.72E-01	1.79E-02	3.47E-04	1.85E-02	4.81E-04	6.48E-03	1.59E-05
Routine Location 3	Daughter Craft O&M Position 3	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 3	CTV1 O&M Position 3	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 3	CTV 2 O&M Position 3	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 3	SOV O&M Position 3	Main Engines	16	1.22	2.06	45.00	1.46	555	6.33E-01	2.20E-02	5.67E-03	2.27E-02	5.90E-04	7.94E-03	2.60E-04
Routine Location 3	SOV O&M Position 3	Auxiliary Engines	16	0.91	3.18	45.00	2.25	555	5.72E-01	1.79E-02	3.47E-04	1.85E-02	4.81E-04	6.48E-03	1.59E-05
Routine Location 4	Daughter Craft O&M Position 4	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 4	CTV1 O&M Position 4	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 4	CTV 2 O&M Position 4	Engines	6	0.62	3.71	Vertical	3.71	555	1.41E-01	4.60E-03	9.18E-05	4.75E-03	1.24E-04	1.66E-03	4.22E-06
Routine Location 4	SOV O&M Position 4	Main Engines	16	1.22	2.06	45.00	1.46	555	6.33E-01	2.20E-02	5.67E-03	2.27E-02	5.90E-04	7.94E-03	2.60E-04
Routine Location 4	SOV O&M Position 4	Auxiliary Engines	16	0.91	3.18	45.00	2.25	555	5.72E-01	1.79E-02	3.47E-04	1.85E-02	4.81E-04	6.48E-03	1.59E-05
Heavy Logistics	US Jack-up	Main Engine 1	65	0.80	3.60	45.00	2.55	555	2.23E+00	6.67E-02	2.89E-03	6.89E-02	1.79E-03	2.41E-02	1.33E-04
Heavy Logistics	US Jack-up	Main Engine 2	65	0.80	3.60	45.00	2.55	555	2.23E+00	6.67E-02	2.89E-03	6.89E-02	1.79E-03	2.41E-02	1.33E-04
Heavy Logistics	US Jack-up	Main Engine 3	65	0.80	3.60	45.00	2.55	555	2.23E+00	6.67E-02	2.89E-03	6.89E-02	1.79E-03	2.41E-02	1.33E-04
Heavy Logistics	US Jack-up	Main Engine 4	65	0.80	3.60	45.00	2.55	555	2.23E+00	6.67E-02	2.89E-03	6.89E-02	1.79E-03	2.41E-02	1.33E-04
Heavy Logistics	US Jack-up	Main Engine 5	65	0.80	3.60	45.00	2.55	555	2.23E+00	6.67E-02	2.89E-03	6.89E-02	1.79E-03	2.41E-02	1.33E-04
Heavy Logistics	US Jack-up	Auxiliary Engine	65	0.80	9.09	45.00	6.43	555	5.52E+00	1.48E-01	2.87E-03	1.53E-01	3.98E-03	5.35E-02	1.32E-04
IAC Repair	Inter Array Cable repair vessel	Main Engine	6	0.61	12.49	Vertical	12.49	555	3.84E+00	1.33E-01	3.44E-02	1.38E-01	3.58E-03	4.81E-02	1.58E-03
IAC Repair	Inter Array Cable repair vessel	Auxiliary Engine	6	0.61	1.06	Vertical	1.06	555	3.38E-01	1.06E-02	2.05E-04	1.10E-02	2.85E-04	3.83E-03	9.43E-06
			Height above ocean (m)	**SigmaY (m)**	**SigmaZ (m)**										
Transit NJWP	Line Volume *		65	27.9	15.1				1.43E+00	4.19E-02	1.62E-03	4.33E-02	1.13E-03	1.52E-02	7.46E-05
Transit Atlantic City	Line Volume *		6	9.3	1.4				7.45E-01	2.44E-02	4.88E-04	2.52E-02	6.56E-04	8.83E-03	2.24E-05

*Line source modelled as volume sources

APPENDIX B
FIGURES OF EMISSION SOURCE LOCATIONS

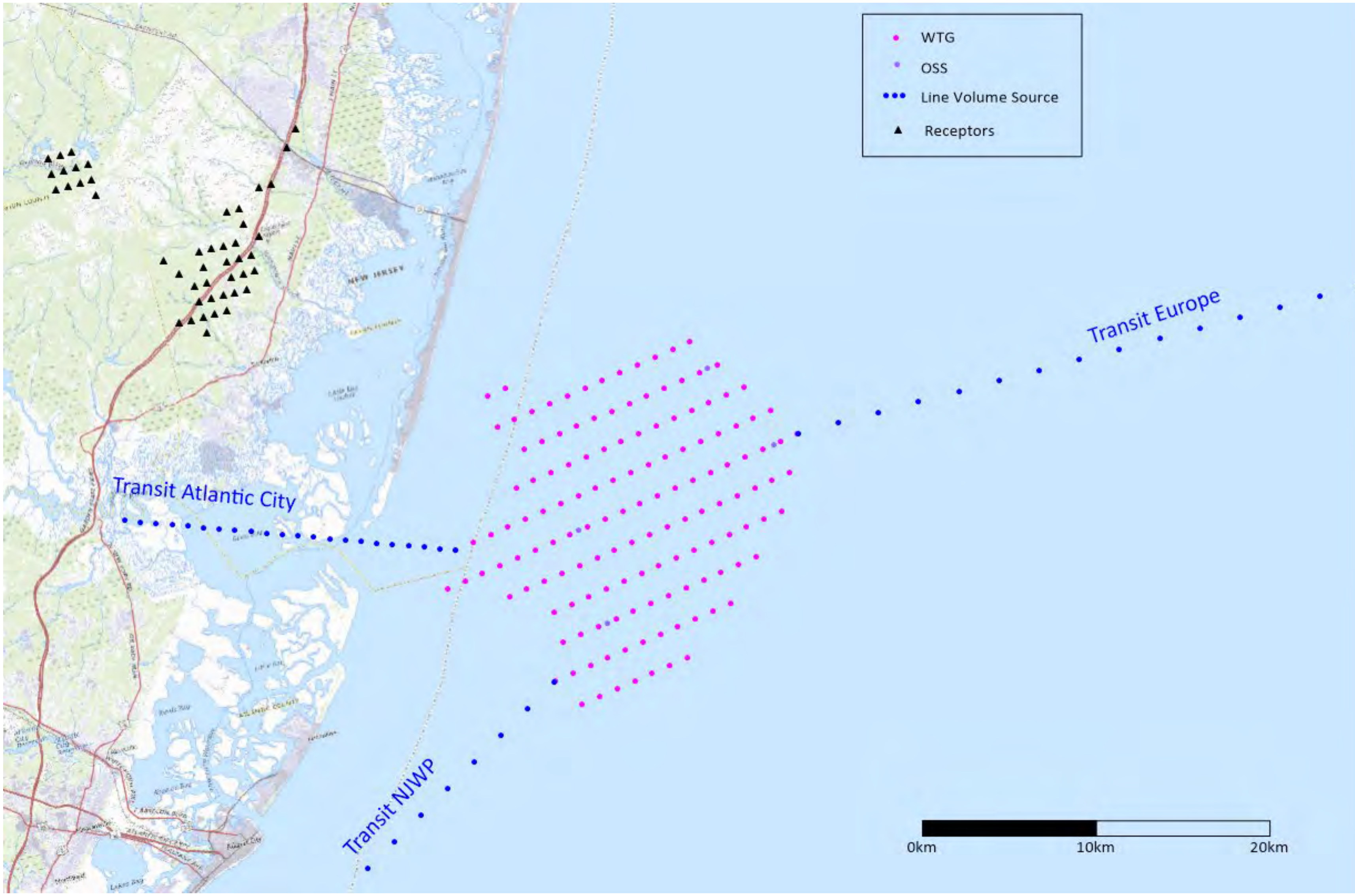


Figure B-1 Locations of Annual Construction Emission Sources

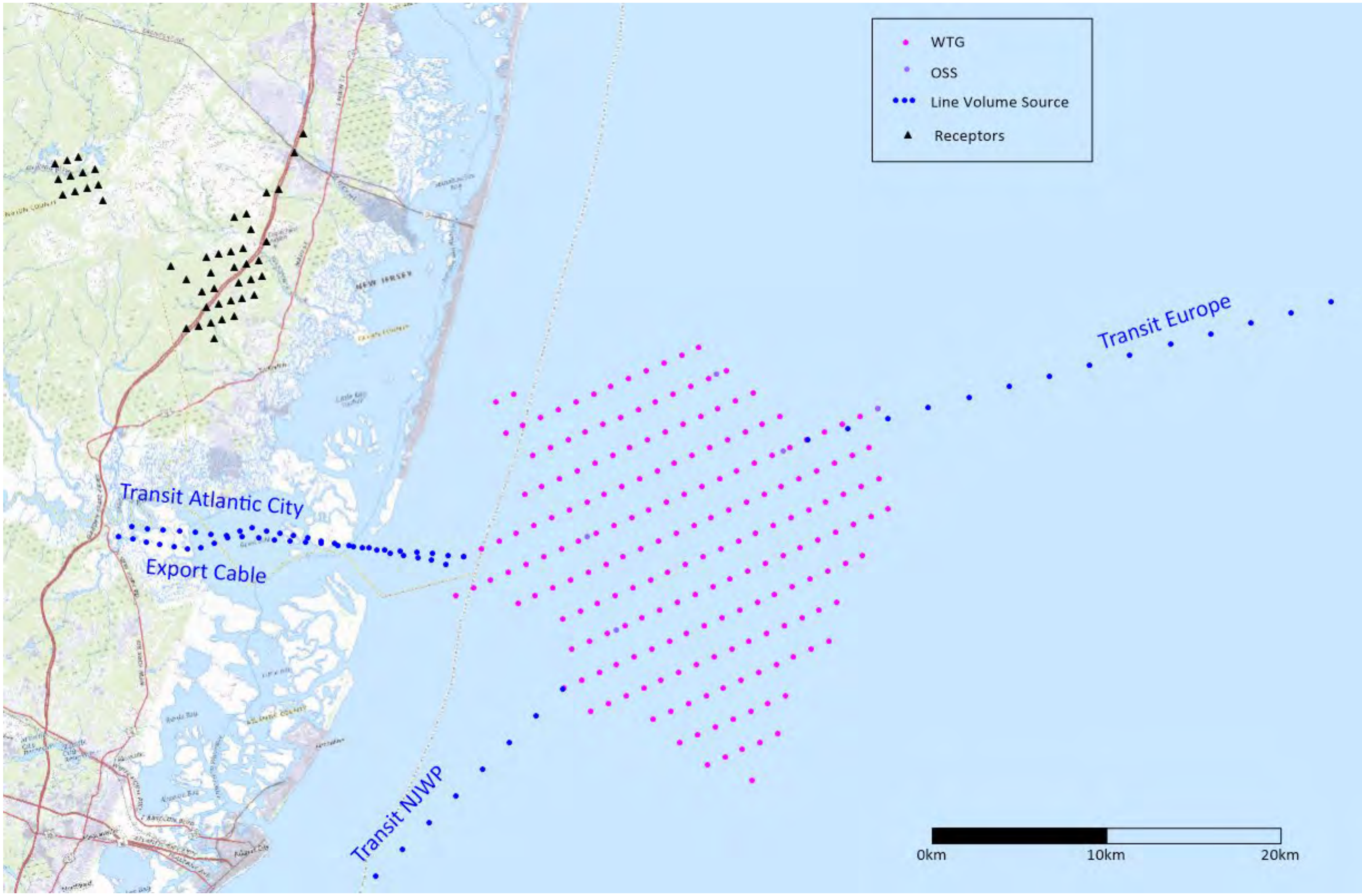


Figure B-2 Locations of Annual O&M Emission Sources

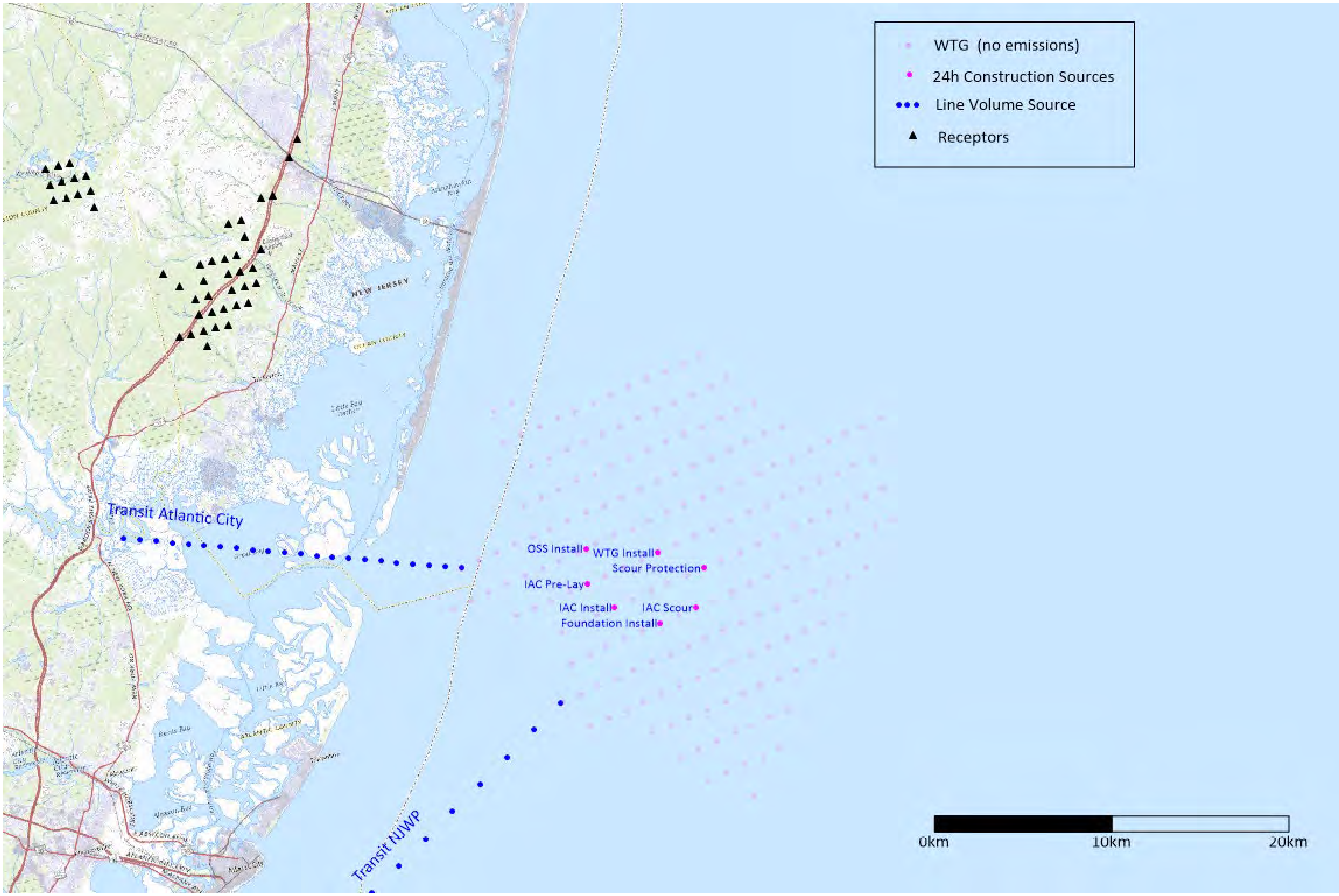


Figure B-3 Locations of 24h Construction Emission Sources

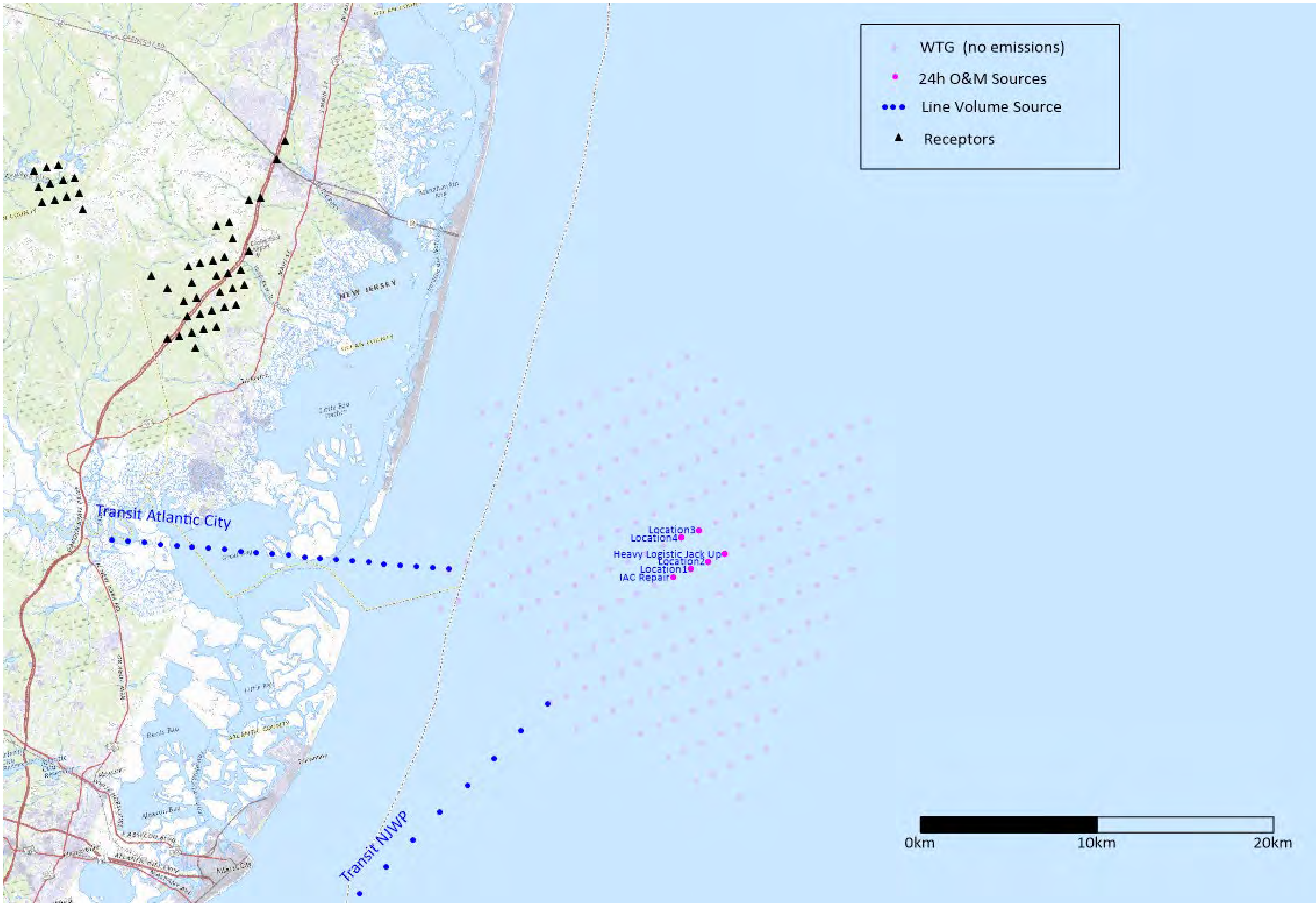


Figure B-4 Locations of 24h O&M Emission Sources

Attachment 4:

Fact Sheet Accompanying Draft Permit

U.S. Environmental Protection Agency
Region 2

FACT SHEET

For an OUTER CONTINENTAL SHELF AIR PERMIT

to Construct and Operate

Atlantic Shores Offshore Wind Project 1, LLC

Atlantic Shores Project 1 and Project 2

EPA Draft Permit Number: OCS-EPA-R2 NJ 02

Date: July 11, 2024

I. BACKGROUND

On September 1, 2022, Atlantic Shores Offshore Wind, LLC submitted an Outer Continental Shelf ("OCS") air permit application ("application") to the U.S. Environmental Protection Agency ("EPA") Region 2 office pursuant to section 328 of the Clean Air Act ("CAA" or the "Act"), 42 U.S.C. § 7627, and 40 C.F.R. Part 55. In its application, Atlantic Shores requested an OCS air permit for the construction and operation of the Atlantic Shores Project ("Atlantic Shores project," "project," or "facility") on the OCS approximately 7.6 nautical miles ("nm") (or 8.7 statute miles)[1] from the New Jersey shoreline. Atlantic Shores submitted revisions and additional information to its application on multiple dates, and the EPA determined that the Atlantic Shores application was complete on August 21, 2023. On June 5, 2024, Atlantic Shores Offshore Wind, LLC requested that EPA transfer ownership of the pending permit application to Atlantic Shores Offshore Wind Project 1, LLC ("Atlantic Shores" or "the applicant" or "the permittee"), along with its affiliate, Atlantic Shores Offshore Wind Project 2, LLC ("Atlantic Shores Project 2 Company").[2] Atlantic Shores Offshore Wind Project 1, LLC subsequently submitted an updated OCS air permit application on June 28, 2024. A copy of the final permit application and additional supporting documents are included in the administrative record and available in the docket for this permitting action (docket number EPA-R02-OAR-2024-0312 at regulations.gov.

The application identifies various types of emission sources (namely, engines on vessels, on wind turbine generators, and on offshore substations) that will be associated with the Atlantic Shores project. However, in its application, the applicant states that most or all of its construction and commissioning ("C&C") and operations and maintenance ("O&M") contracts will be finalized after the project reaches financial closure, which will occur after all permits, including the OCS air permit, are issued. According to the applicant, the actual specifications of the vessels and engines (model years, displacements, etc.) will depend on vessel and contractor availability, which is also dependent on the final construction schedule of the Atlantic Shores project. Therefore, the information provided in the application is based on representative vessel types necessary for this type of project.

After reviewing the application, the EPA prepared the draft OCS air permit (or "draft permit") for the Atlantic Shores project[3], which is subject to public notice and a 30-day public comment period. In processing this application, the EPA has followed the administrative and public

---

[1]All "miles" referenced in this Fact Sheet are "nautical miles." One nautical or geographical mile is equal to 1.15 statute miles. Requirements under Section 328 of the CAA and 40 C.F.R Part 55 differ depending on whether the project is located within or beyond 25 miles from a States' seaward boundaries (*see* Section VI of this Fact Sheet for further discussion), but do not specify whether these are statute miles or nautical miles. However, the Outer Continental Shelf Lands Act ("OCSLA") (43 U.S.C. § 1331 *et seq*.) refers to nautical or geographical miles. Thus, the 25 miles are considered nautical ("nm") or geographical miles. 25 nautical miles are equal to 28.8 statute miles.
[2] Actions taken by Atlantic Shores Offshore Wind, LLC (prior to transfer) and by Atlantic Shores Offshore Wind Project 1, LLC (after transfer) are both considered to be actions by the permit applicant, and are referred to as such in this Fact Sheet.
[3] Note that the requirements of Title V of the Clean Air Act are not part of this permitting action, and will be addressed at a later time. *See* Section IX of this Fact Sheet ("Scope of Stationary Source and Major Facility") for more information.

OSSs. Atlantic Shores will mount the WTGs on either monopile[6] or piled jacket[7] foundations. A transition piece would then be fitted over the monopile and secured via bolts or grout. The OSSs would be installed on piled jacket foundations. Where required, scour protection would be placed around foundations to stabilize the seabed near the foundations. *See* Figure 2 below for diagrams of representative foundation types for the WTGs and OSSs. The OSSs would serve as the interconnection points between offshore and onshore components. Each OSS will include transformers, switchgears, and shunt reactors to increase the voltage of the power captured from the inter-array cables and control the flow through the export cables, so that the electricity can be efficiently transmitted onshore through submarine export cables.[8] These offshore components are on the OCS (with the exception that the portion of the offshore submarine export cables within 3 nm of the NJ shore would be in state waters).

The proposed project's onshore components are not subject to the OCS air regulations and thus will not be covered by the OCS air permit. Those onshore components include components such as the following: two export cable landfall areas in the state of NJ; two onshore export and interconnection cable routes; two onshore substations in the state of NJ where electricity will be transmitted to the electric grid; an onshore staging port where project components and equipment will be staged; and one operation and maintenance facility with offices, control rooms, warehouses, workshop space, and pier space. Onshore components are being addressed in separate federal, state, and/or local permitting or government review processes that would provide for public review within their own regulatory frameworks and are outside the scope of this OCS air permit.

The Atlantic Shores project will consist of three phases: construction and commissioning ("C&C"), operations and maintenance ("O&M") and decommissioning. The offshore construction covered by this OCS air permit is anticipated to begin in Q1-2026 and be completed within two years. The anticipated commercial lifespan of the project (which is the O&M phase) is 30 years.

The OCS air permit will cover the offshore portion of the C&C and O&M phases of the project located on the OCS. There will also be a decommissioning phase at the end of the project's anticipated operational life, which will involve the use of various marine vessels

---

[6]A monopile foundation typically consists of a single tubular section. For more details, *see* BOEM's Final Environmental Impact Statement ("FEIS") for Atlantic Shores, which can be found at https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-south-final-environmental-impact.

[7]Piled jacket foundations are formed by a steel lattice construction, composed of tubular steel members, and welded joints, and secured to the seabed by hollow steel pin piles attached to each of the jacket feet.
For more details, *see* BOEM's COP for Atlantic Shores, which can be found at https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

[8]Each OSS's topside will also include auxiliary equipment, uninterruptible power supplies, cranes, freshwater storage, a backup diesel generator, diesel fuel storage, utility pumps for systems such as freshwater, diesel fuel, and cooling, oil containment, fire detection and firefighting equipment, transformers, and other equipment. For further description of the components of an OSS, *see* the Atlantic Shores Construction and Operations Plan submitted to BOEM, available at
https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

and construction equipment to remove the project's structures from the OCS. This permit does not authorize the permittee to commence any such decommissioning activities. The OCS air permitting requirements for decommissioning will be determined at that time because it is expected that marine vessel technology will substantially change over the next 30 years. Any OCS air permitting requirements applicable to decommissioning activities will be determined following the permittee's submission of information sufficient for EPA to determine whether a new or revised preconstruction permit will be required to comply with CAA requirements.

Atlantic Shores states that they have not yet selected the specific vessels that will carry out the offshore construction activities. Therefore, for the purposes of this OCS application, Atlantic Shores provided representative vessel types rather than specific vessels, and vessel specifications were based on typical ranges for each type of vessel. Because the number of vessels and the number of vessel trips depend on the specific vessels used, estimates were generated using sample vessels and preliminary project plans. Atlantic Shores proposes to use various marine vessels, which have onboard marine engines[9] and construction equipment, for the following purposes: (1) for the C&C phase to construct the above-described offshore project components; and (2) for the O&M phase to maintain and repair the offshore project components. The following is a list of the main activities that will occur in the C&C and O&M phases and the types of marine vessels (which will have propulsion and auxiliary marine engines) associated with each of those activities:

C&C (vessel types in parenthesis):
(1) **Foundation Installation** (bubble curtain support tugboat, transport barge, towing tugboat, service operation vessel, crew transfer vessel);
(2) **OSSs Topside and Foundation Installation** (large heavy lift vessel, medium heavy lift vessel, bubble curtain support tugboat, transport barge, towing tugboat, assistance tugboat, crew transfer and noise monitoring vessel);
(3) **Scour Protection** (fall pipe vessel, dredger);
(4) **WTG Installation** (jack-up vessel, towing tugboat, jack-up feeder vessel, harbor tugboat, service operation vessel, crew transfer and commissioning vessel);
(5) **Export and Inter-array Cable Installation** (cable installation vessel, service operation vessel, cable installation vessel, dredger, anchor handling tug supply vessel, fall pipe vessel); and
(6) **Fuel Bunkering** (towing tugboat, transport barge).

Atlantic Shores will also use marine engines that will be located onboard marine vessels to power construction equipment on those vessels during C&C or to power each WTG and OSS

[9] 40 C.F.R. § 1042.901 defines a "marine engine" as "a nonroad engine that is installed or intended to be installed on a marine vessel. This includes a portable auxiliary marine engine only if its fueling, cooling, or exhaust system is an integral part of the vessel. A fueling system is considered integral to the vessel only if one or more essential elements are permanently affixed to the vessel. There are two kinds of marine engines: (1) Propulsion marine engine means a marine engine that moves a vessel through the water or directs the vessel's movement. (2) Auxiliary marine engine means a marine engine not used for propulsion."

In addition to the air quality impacts analyzed above, Atlantic Shores also addressed project impacts on the Class I areas, as required by PSD regulations. The nearest Class I area to the project is the Brigantine National Wilderness Area located in E.B. Forsythe National Wildlife Refuge in New Jersey (approximately 15 km from the nearest project boundary). As indicated in Table 7, the AERMOD results are only greater than the Class I area SILs for 24-hour PM_{10} and 24-hour $PM_{2.5}$. The Class I PSD increment assessment is provided in Table 8.

Table 7 - AERMOD Modeled Concentrations as Compared to the Class I SIL for the Construction and O&M Phases

Pollutant	Averaging Period	Modeled Concentration (µg/m^3)		Class I SIL (µg/m^3)
		Construction	**O&M**	
NO_2	Annual	0.088	0.0515	0.1
PM_{10}	24-hour	0.942	0.4595	0.3
	Annual	0.003	0.0019	0.1
$PM_{2.5}$	24-hour	0.916	0.4808	0.27
	Annual	0.003	0.0019	0.03

Table 8 - AERMOD Total Concentrations as Compared to the Class I PSD Increment for the Construction and O&M Phases.

Pollutant	Averaging Period	Total Concentration (µg/m^3)		Class I PSD Increment (µg/m^3)
		Construction	**O&M**	
NO_2	Annual	0.088	0.051	2.5
PM_{10}	24-hour	0.68	0.36	8
	Annual	0.0031	0.0019	4
$PM_{2.5}$	24-hour	0.69	0.44	2
	Annual	0.0068	0.0031	1

Clean Air Act regulations provide that the Federal Land Manager has the affirmative responsibility to protect the Air Quality Related Values ("AQRVs") in Class I areas, including visibility. *See* 40 C.F.R. § 52.21(p). The Federal Land Manager for Class I areas managed by the U.S. Fish and Wildlife Service ("USFWS") is the Department of the Interior's Assistant Secretary for Fish and Wildlife and Parks. Atlantic Shores conducted modeling to assess the impacts on visibility and acid deposition in the Brigantine Class I area. A procedure, as described in the FLM's Air Quality Related Work Group ("FLAG") guidance (2010)[111], was used to determine the potential AQRV impacts in the Class I area.

The emissions were conservatively based on short-term potential-to-emit emission rates for the project during the construction, operation and major maintenance phases. An AQRV analysis using CALPUFF was conducted for all far-field (>50km) phases. Near field (<50km) analysis using VISCREEN was performed for all operations.

The Federal Land Manager has received timely copies of the Atlantic Shores complete application, and all subsequent revisions, updates, and additional information up until June 28, 2024. *See* 40 C.F.R. § 52.21(p)(1). No review findings have been received from the Federal Land Manager. *See* 40 C.F.R. § 52.21(p)(3) & (4).

E. EPA's Assessment of Atlantic Shores' Air Quality Impact Analysis

EPA has assessed the analyses submitted by Atlantic Shores related to the ambient air impacts during the C&C and O&M phases. EPA concludes that the emissions in either of these phases will not cause or contribute to any violations of the NAAQS or PSD Increment, and Atlantic Shores has satisfactorily met the ambient air quality impact requirements of the PSD regulations.

XIV. ADDITIONAL IMPACT ANALYSES

As required by 40 C.F.R. § 52.21(o) of the PSD regulations, the applicant must provide an analysis of the project impacts on soils, vegetation, and visibility and the expected general commercial, residential, and industrial growth associated with the source.

A. Visibility

The applicant provided the analysis required under 40 C.F.R. § 52.21(o) to assess impairment to visibility that would occur as a result of the air emissions from the source. For the Class II visibility analysis, the project used the VISCREEN model to evaluate impacts on important nearby vistas, namely the Brigantine. The project's maximum potential to emit emission rates were used in the analysis. The VISCREEN Level 2 screening analysis shows that Atlantic Shores' plume visibility in a marine environment improve from the short-lived construction phase to the longer-lived O&M phase, including during a major repair.

B. Soils

[111] The FLAG guidance can be found at: https://irma.nps.gov/DataStore/DownloadFile/420352.

consultation between the EPA and the USFWS and/or the National Marine Fisheries Service ("NMFS"), depending on the species and/or habitat at issue.

In accordance with Section 305(b)(2) of the MSFCMA, 16 U.S.C. § 1855(b)(2), Federal agencies are also required to consult with the NMFS on any action that may result in adverse effects to essential fish habitat ("EFH").

Section 106 of the NHPA, 16 U.S.C. 470f, and the implementing regulations at 36 C.F.R. Part 800 require federal agencies to consider the effect of their actions on historic properties and afford the opportunity for the Advisory Council on Historic Preservation ("ACHP") and consulting parties to consult on the federal undertaking.

The ESA regulations at 50 C.F.R. § 402.07, the MSFCMA regulations at 50 C.F.R. § 600.920(b), and the NHPA regulations at 36 C.F.R. § 800.2(a)(2) provide that where more than one federal agency is involved in an action, the consultation requirements may be fulfilled by a designated lead agency on behalf of itself and the other involved agencies. As previously discussed, BOEM is the designated lead agency for the purposes of fulfilling the EPA's obligations under Section 7 of the ESA, Section 305(b) of the MSFCMA, and Section 106 of the NHPA for offshore wind development projects on the Atlantic OCS, including the Atlantic Shores project. As a result of this designation, BOEM is considering the effects of the EPA's OCS permitting action in fulfilling its consultation obligations under each of these statutes during the NEPA ROD and COP approval process.

On May 31, 2024, BOEM published in the Federal Register[117] the official notice of the availability of the final EIS for the Atlantic Shores project Construction and Operations Plan (which requires BOEM approval), for both the public and CAA Section 309 review.

On July 1, 2024, BOEM issued the Lead Agency ROD for the Final EIS prepared for the Atlantic Shores project COP.[118] The ROD documents the BOEM decision to approve the COP for the Atlantic Shores project. Thus, the EPA understands that BOEM has satisfied its statutory obligations as the lead federal agency under ESA, MSFCMA, and NHPA for the Atlantic Shores project.

B. Coastal Zone Management Act

Section 307 of the Coastal Zone Management Act ("CZMA") and its implementing regulations at 15 C.F.R. Part 930, subpart C require that federal actions within the coastal zone or within the geographical location descriptions (i.e., areas outside the coastal zone in which an activity would have reasonably foreseeable coastal effects) affecting any land or water use or natural

---

[117] A copy of this notice is available at https://www.federalregister.gov/documents/2024/05/31/2024-11947/notice-of-availability-of-a-final-environmental-impact-statement-for-atlantic-shores-offshore-wind.
[118] The ROD is available at https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-south.

resources[119] of the coastal zone[120] be consistent to the maximum extent practicable[121] with the enforceable policies of a state's federally approved coastal management program. Federal actions include federal agency activities, federal license or permit activities, and federal finance assistance activities. The EPA's issuance of an OCS air permit is considered a federal action under the CZMA.[122]

15 C.F.R. Part 930, subpart D requires that a non-federal applicant for a federal license or permit, such as Atlantic Shores, provide a state with a certification of consistency with the state enforceable policies of the coastal management program if the state has identified the federal license or permit on a list of activities subject to federal consistency review in its federally approved coastal management program.

The OCS Lease Area for the Atlantic Shores project is geographically nearest to the coast of New Jersey state.

The EPA's action to issue an OCS air permit under 40 C.F.R. Part 55 is included on the current lists of federal actions for federal consistency review of NJ[123] state. The State of New Jersey administers its federally-approved Coastal Zone Management Program through the NJDEP Coastal Management Program ("NJ CMP"). The NJ CMP is outlined in the Coastal Zone Management Rules (N.J.A.C. 7:7) which establish the requirements for review of development applications under the Coastal Area Facility Review Act, N.J.S.A. 13:19-1 et. seq. (CAFRA

---

[119]*See* 15 C.F.R. § 930.11 ("*Any coastal use or resource.* The phrase "any coastal use or resource" means any land or water use or natural resource of the coastal zone. Land and water uses, or coastal uses, are defined in sections 304(10) and (18) of the act, respectively, and include, but are not limited to, public access, recreation, fishing, historic or cultural preservation, development, hazards management, marinas and floodplain management, scenic and aesthetic enjoyment, and resource creation or restoration projects. Natural resources include biological or physical resources that are found within a State's coastal zone on a regular or cyclical basis. Biological and physical resources include, but are not limited to, air, tidal and nontidal wetlands, ocean waters, estuaries, rivers, streams, lakes, aquifers, submerged aquatic vegetation, land, plants, trees, minerals, fish, shellfish, invertebrates, amphibians, birds, mammals, reptiles, and coastal resources of national significance. Coastal uses and sources also include uses and resources appropriately described in a management program.").
[120]*See* CZMA § 304(1), 16 U.S.C. § 1453(1) ("The term 'coastal zone' means the coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal states, . . . The zone extends . . . seaward to the outer limit of State title and ownership under the Submerged Lands Act (43 U.S.C. 1301 et seq.) [and other statutes] as applicable. . .. Excluded from the coastal zone are lands the use of which is by law subject solely to the discretion of or which is held in trust by the Federal Government, its officers, or agents."); 15 C.F.R. § 930.11 ("*Coastal Zone.* The term 'coastal zone' has the same definition as provided in § 304(1) of the Act.").
[120] *See* 15 C.F.R. § 930.32(a)(1) ("The term 'consistent to the maximum extent practicable' means fully consistent with the enforceable policies of management programs unless full consistency is prohibited by existing law applicable to the Federal agency.").
[121]*See* 15 C.F.R. § 930.32(a)(1) ("The term 'consistent to the maximum extent practicable' means fully consistent with the enforceable policies of management programs unless full consistency is prohibited by existing law applicable to the Federal agency.").
[122]The issuance by BOEM, another federal agency, of the construction and operation plan for the Atlantic Shores project also constitutes a federal action under the CZMA.
[123] See "NEW JERSEY COASTAL MANAGEMENT PROGRAM FEDERAL CONSISTENCY LISTINGS FEDERAL ACTIVITIES; LICENSES, PERMITS AND OTHER REGULATORY APPROVALS; AND FEDERAL FINANCIAL ASSISTANCE PROGRAMS" available at https://coast.noaa.gov/data/czm/consistency/media/nj.pdf.

permits), the Wetlands Act of 1970 N.J.S.A. 13:9A-1 et. seq. (coastal wetland permits), and the Waterfront Development Law N.J.S.A. 12:5-3 (waterfront development permits).

Although BOEM is not requiring the submittal of a consistency certification under 30 C.F.R. § 585.627(a)(9), as the Atlantic Shores Project is not within a state's geographical location description, Atlantic Shores prepared a Consistency Certification to demonstrate that the proposed Project located within BOEM Lease Area OCS-A 0499 is consistent with the policies identified as enforceable by N.J.A.C. 7:7. Atlantic Shores most recently submitted to BOEM an updated certification of consistency[124] with the NJ CMP in May 2024, and a copy of this document is in the docket for this draft permit action. Atlantic Shores states that the Project is consistent, to the maximum extent practicable, with the enforceable policies of the NJ CMP.

NJDEP has determined that the proposed activity will be conducted in a manner consistent with New Jersey's CZMP and pursuant to 15 C.F.R. Part 930, which authorizes states with approved CZM programs to conduct a coastal zone consistency review and concurrence determination of projects within or outside the state coastal zone boundary.[125] A copy of the New Jersey's concurrence is in the docket for this draft permit action. Projects that require a federal license or permit, are federally funded, or are a direct activity of a federal agency are to be reviewed to ensure that activities in or affecting the state's coastal zone are consistent with the state's enforceable program policies.

XVII. OTHER REQUIREMENTS

A. Indian Nation Consultation

Executive Order 13175 commits federal agencies to engage in consultation with tribes when federal actions have tribal implications. Although there are several state-recognized Indian Nations in New Jersey, none are federally-recognized. Therefore, no consultation and coordination regarding this project is necessary under the EPA Policy on Consultation and Coordination with Indian Tribes.[126]

B. Clean Air Act General Conformity

Pursuant to 40 C.F.R. § 93.153(d)(1), a conformity determination is not required for the portion of an action that includes major or minor new or modified stationary sources that require a permit under the NSR program.

XVIII. COMMENT PERIOD, HEARINGS, AND PROCEDURES FOR FINAL PERMIT DECISION

---

[124] The certification of consistency is available at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/2024-05-01_App%20I-C_CZMA%20Consistency%20Certification.pdf.
[125] According to Section 5.3.7.6 of BOEM's ROD, New Jersey concurred with certain conditions, which will be made a part of the U.S. Army Corps of Engineers permit.
[126] *See* EPA Policy on Consultation and Coordination with Indian Tribes, available at https://www.epa.gov/tribal/epa-policy-consultation-and-coordination-indian-tribes.

Attachment 5:

Draft Permit Issued July 11, 2024

U.S. Environmental Protection Agency
Region 2

OUTER CONTINENTAL SHELF AIR PERMIT

Issued to

Atlantic Shores Offshore Wind Project 1, LLC

For the

Atlantic Shores Project 1 and Project 2

EPA Permit Number: OCS-EPA-R2 NJ 02

Issue Date: *Draft* Effective Date: *Draft*

In accordance with the provisions of section 328 of the Clean Air Act, 42 U.S.C. § 7627, and the implementing Outer Continental Shelf ("OCS") air regulations at title 40 of the Code of Federal Regulations ("C.F.R."), Part 55, the United States Environmental Protection Agency, Region 2 Office ("EPA") is proposing to issue an OCS air quality permit to:

Atlantic Shores Offshore Wind Project 1, LLC
1 Dock 72 Way, Floor 7
Brooklyn, NY 11205

Atlantic Shores Offshore Wind Project 1, LLC is hereby authorized to construct and operate the offshore wind farm project located on the OCS within the lease area OCS-A 0499, about 7.6 nautical miles (8.7 statute miles) from the New Jersey shoreline. The construction and operation of the wind farm shall be subject to the attached permit conditions and permit limitations.

Draft *Draft*

_________________________ ____________________

Richard Ruvo, Director Date
Air and Radiation Division

Attachment 6:

Response to Comments Accompanying Final Permit

U.S. Environmental Protection Agency
Region 2

RESPONSE TO PUBLIC COMMENTS

OUTER CONTINENTAL SHELF AIR PERMIT

EPA Permit Number: OCS-EPA-R2 NJ 02

For the

Atlantic Shores Offshore Wind Project 1, LLC
Atlantic Shores Project 1 and Project 2

September 29, 2024

Introduction

On July 11, 2024, the U.S. Environmental Protection Agency, Region 2 Office ("EPA") issued for public review a draft Clean Air Act Outer Continental Shelf ("OCS") air permit to Atlantic Shores Offshore Wind Project 1, LLC ("Atlantic Shores" or "the applicant" or "the Permittee") to develop OCS lease area OCS-A 0499 into two wind farms, known as Atlantic Shores Project 1 ("ASP1") (1,510 MW) and Atlantic Shores Project 2 ("ASP2") (target capacity of 1,327 MW), collectively referred to as the OCS Facility, the Atlantic Shores Project, or the project.

The draft permit was available for public comment from July 12, 2024, through August 16, 2024. In addition to accepting written comments during that time, the EPA held a virtual public hearing on August 12, 2024. A total of approximately 611 commenters submitted written comments to the EPA. In addition, 16 commenters provided oral comments during the virtual public hearing. A copy of the hearing transcript is available at docket number EPA-R02-OAR-2024-0312 at regulations.gov. The majority (over 92%) of the total comments received were supportive of the proposed project. Opposing commenters provided a variety of reasons for opposing the project, which are presented in this document along with EPA responses to those comments.

After a careful review of all the public comments received, the EPA is issuing the final OCS air permit ("final permit") for the Atlantic Shores Project. As required by 40 C.F.R. Part 124 ("Procedures for Decision Making"), the EPA has prepared this document, known as the "Response to Comments" ("RTC"), that addresses all comments received during the public comment period.

Because of the variety of comments received, EPA has organized the comments and its responses into 11 separate subject-based sections. For simplicity, EPA consolidated comments that were identical or similar as if the comments were made by a single commenter. Only relevant comments were included in this summary (although not all are within the scope of this permitting action). Some comments have been edited for clarity and brevity. The 11 sections in this RTC document are:

Finally, at the end of this RTC beginning on Page 109, we included a "Summary of All Changes from Draft OCS Permit to Final OCS Permit as a Result of Comments Received During the Public Comment Period."

Section 1.0 - Sulfur Hexafluoride (SF_6) Emissions

Comment 1.1
This project will utilize more than 47,000 lb of SF_6 in offshore substations. Despite measures to keep this GHG from escaping, "leak rates" are fully expected during normal operations and maintenance of 0.5 to 1% per year. That, of course, is assuming that there are no accidental releases such as what happened at the Seagreen offshore wind area in the North Sea. Twenty-four pounds of SF_6 leaked during routine work in 2022 in which 80 workers had to be evacuated.

Response 1.1
The maximum amount of SF_6 that will be utilized by the project has not been finalized because the facility has not yet completed its final design plans. However, the permit limits annual emissions from leaks of SF_6 (converted to the unit of carbon dioxide equivalents, or CO_2e) during the operations and maintenance (O&M) phase of the project to no more than 3,519 tons of CO_2e per year (and limits CO_2e emissions from all OCS sources regulated under the permit combined to a total of 30,387 tons of CO_2e per year). This means that SF_6 emissions may account for up to about 11.6% of the total CO_2e emissions from the project's OCS sources. In addition, to minimize potential SF_6 emissions, the OCS permit requires the use of SF_6-free switches on level 1 of the offshore substations, where the applicant has identified that use of such switches is feasible (given considerations such as market availability of the SF_6-free switches for the needed power, size, and weight of the equipment). Moreover, for switchgears where no viable SF_6-free switches are currently available, the OCS permit contains requirements to install SF_6 leak detection and monitoring systems and specifies procedures to repair any potential leakages in a timely manner. Also *see* Response 1.3 for additional future requirements to minimize SF_6-containing switchgears.

Comment 1.2
Have the residents of Atlantic City been informed of the use of these toxic greenhouse emitting chemicals in this project? According to BOEM documents, the following chemicals will be used by the Atlantic Shores Project…. Have the residents living in close proximity been informed of the use of SF_6, one of the most potent and persistent greenhouse gas known to man? The U.S Environmental Protection Agency reported, 'SF_6 is the most potent greenhouse gas known. It is 23,500 times more effective at trapping infrared radiation than an equivalent amount of CO_2 and stays in the atmosphere for 3,200 years.' The agency also notes that a relatively small amount can 'have a significant impact on global climate change' and that leaks can occur during 'installation, maintenance and servicing.' Employees must evacuate the work area during leak events. The question is how many such leaks go unreported."

Response 1.2
SF_6 is a greenhouse gas that is used as insulation in the electricity industry to keep networks running safely and reliably. Around 80% of the SF_6 used globally is in electricity transmission and distribution. Medium- and high-voltage equipment contains SF_6 to insulate the live electrical parts and to switch the flow of electrical current on and off. The same equipment is also used to connect generation and storage components of renewable energy systems. The applicant's estimates indicate that SF_6 emissions from leaks may account for about 11.6% of

the total CO_2e emissions from the project's OCS sources during the O&M phase. This OCS permit addresses the use of SF_6 in the Atlantic Shores Project's offshore equipment (not onshore switchgear equipment); Table 3 in the OCS permit outlines where the SF_6 will be used.

The discussion in Response 1.1 addresses the requirements in the OCS permit to minimize SF_6 emissions from leaks from the Atlantic Shores Project. SF_6-free switchgears are currently not technically and economically available in the marketplace for all high voltage applications. Also *see* Response 1.3 for additional future requirements to minimize SF_6-containing switchgears. *See* Response 3.2 for communications with the Atlantic City community.

Comment 1.3
We strongly urge EPA to explore all possible alternatives to avoid the potential leakage of SF_6. As an obvious example, we are pleased to see that Atlantic Shores will be using SF_6 alternatives (G3-insulated bus ducts) on the OSSs for bus ducts on level 1 related to the inter-array cables. Similarly, Atlantic Shores itself notes that "it may be possible to replace up to 106 SF_6 switchgears with non-SF_6 versions for the Project 1 wind turbine generators (WTGs) based on the state of available technology." 2.1.3 AS Oct 28 2022 Submittal in Response to EPA Comments Sept 30 2022, Doc. ID No. EPA-R02-OAR-2024-0312-0032, at 9.

Moreover, even if EPA agrees with Atlantic Shores that non-SF_6 technology is not BACT for Project 1, EPA should defer such a determination for Project 2. As Atlantic Shores acknowledges, the rapid pace of technological development in wind technology indicates that cleaner options are likely imminently available. See id. ("the recent pace of WTG technology development makes it possible that the WTG model that will be used for Project 2 is not available on the market today"). Again, given the global warming potential of SF_6, we urge EPA to be careful in making a BACT determination.

Similarly, we urge EPA to not regard this as the end of the discussion on SF_6—given 5-year re-permitting cycle for Title V permits and further permitting requirements on the part of New Jersey Department of Environmental Protection (NJDEP), we recommend reassessing SF_6 emissions every 5 years to consider all new technology options that could become technically feasible for the project's specific space and weight requirements if the gas insulated switchgears in question can be mechanically replaced and as they are replaced due to wear and tear.

Response 1.3
The OCS permit does not lock the project into installing switchgears containing SF_6. As the project design progresses and more SF_6-free switchgears become available for a specific application, the permit does not prevent the facility from using more SF_6-free switchgears in lieu of switchgears containing SF_6 in the final project design. In addition, in light of this comment, EPA is revising Permit Condition IV.D.2.e. to require the applicant to consider the technical and economic viability of installing SF_6-free switchgears whenever an SF_6-containing switchgear needs to be replaced with a new one. *See* Response 7.11(e) for the revised condition.

Comment 1.4
Any proposed SF_6 mitigation measure must be comprehensive and prioritize safety over financial compensation. The potential for catastrophic accidents from leakage of SF_6 alone, necessitates a

more substantial and comprehensive mitigation strategy that addresses the full scope of mitigation measures and risks these turbines introduce.

Response 1.4

The OCS permit contains requirements to install SF_6 leak detection and monitoring systems and specify procedures to repair any potential leakages in a timely manner. Such systems and procedures are the current standard industrial practices for SF_6-containing switchgears in many existing offshore wind farm projects. The commenter did not identify what a "more substantial and comprehensive mitigation strategy…" would be. Therefore, the commenter has not provided EPA with a basis to change the above-mentioned requirements, and EPA is leaving them unchanged. *See also* Response 1.1.

In addition to the requirements in the OCS air permit, the Atlantic Shores Project will have to comply with requirements imposed, *inter alia*, by BOEM's ROD (*see* Response 4.1 for a link to the ROD), which implements many mitigation measures to prevent accidents from occurring or causing environmental or human health degradation. Specific to SF_6 concerns, page 89 of the ROD states, in part:

> *The Lessee must follow International Electrotechnical Commission and requirements in EPA's OCS air permits for SF_6 leak detection and monitoring requirements. The Lessee must also follow manufacturer recommendations for service and repair of the affected breakers and switches and conduct visual inspections of the switchgears and monitoring equipment according to manufacturer recommendations.*

Comment 1.5

The draft permit directs Atlantic Shores to use G3 equipment when possible and requires mitigation measures such as alarms to detect leaks as soon as they occur; following manufacturer-prescribed maintenance, monitoring, and emissions minimization measures; completely replacing switchgears containing SF_6 in the event that damage occurs; and only using equipment that guarantees an annual emissions rate of less than 0.5% of the weight of the SF_6 stored in the turbines. Offshore monitoring and enforcement on large scale wind powerplants is untested in US waters. Given the climate impacts of SF_6, EPA must require the applicant to prove the ability for reporting and compliance with the above-described limitations. In the meantime, the government should be investing more in the development of alternatives to SF_6 so that this chemical can be banned.

Also, as a matter of protective policy, and considering the extraordinary global warming potential of SF_6, the air quality impacts of other offshore wind projects planned for the New York Bight should also be considered and added to the impacts contemplated in Atlantic Shores' draft air permit. This must also include the pre-construction surveying activities conducted during the planning and design phases of Projects 1 and 2.

Response 1.5

As discussed in Response 1.4, the SF_6 offshore monitoring and enforcement protocols in the permit follow current standard industrial practices being used at wind farms offshore Europe and the United States. EPA has no data at hand or reason to believe that the SF_6 offshore monitoring and enforcement protocols in the permit will not work in US waters as they have at European wind farms. The commenter has likewise not provided or identified any such data or the need for such data. Vineyard Wind 1 and, more recently, South Fork Wind are already delivering electricity from their respective wind farms to US utilities using similar protocols without reported problems related to the existing protocols. Whether the US government should invest more in the development of alternatives to SF_6, as the commenter suggests, is outside the scope of this permit proceeding.

The climate impacts of greenhouse gases are a global problem, not a localized issue. Therefore, with regards to climate change-related impacts from SF_6, the commenter's suggestion to combine and review the GHG impacts from SF_6 from this project and other offshore wind projects planned for the New York Bight would not provide any particularly useful data. Finally, BOEM's Record of Decision (ROD) states that the project purpose and need for the project, as provided by the applicant and reviewed by the US Army Corp of Engineers, "will help both the United States and New Jersey achieve their renewable energy goals, diversify the State's electricity supply, increase electricity reliability, and reduce greenhouse gas emissions." *See* BOEM's ROD at page 50 of 208.

Pre-construction surveying activities conducted during the planning and design phases of Projects 1 and 2, and the impacts of those activities, are outside the scope of this OCS permit.

Section 2.0 – Utilization of the Most Efficient Marine Vessels

Comment 2.1
The permit application does not require the Atlantic Shores Project to utilize the most efficient marine vessels for the construction and maintenance of these projects. In the permit application, it specifically states that "the air emission estimates presented in this application are subject to change." By how much? No permit should be granted until they are required to operate the most efficient vessels available to reduce the air quality impact to our State.

Response 2.1
The applicant has not yet contracted the marine vessels it will use, and thus in its application, it relied on representative vessels and marine engines to estimate its emissions and impacts and to conduct Clean Air Act emissions analyses. Its ability to contract for specific vessels will depend on the pool of marine vessels that are available on the timeline needed for deployment. However, the draft OCS permit and final permit both contain permit conditions, such as daily emission limits and annual potential to emit limits, that limit the OCS Facility's emissions to the levels the applicant indicated in estimates and analyses and which the applicant used to demonstrate compliance with Clean Air Act requirements.

In addition, the permit contains permit conditions regarding choosing the cleanest (most efficient) OCS source vessels available. The application proposed that, since the applicant has not yet contracted any OCS source vessels for the project, it would use the marine vessels with the highest-tiered (i.e., cleanest, and thus the most efficient) engines available at the time of deployment. The draft OCS permit already contains a permit condition that requires the facility, for each OCS source vessel, to contract the OCS source vessel with the highest-tiered engines that would be available at the time of contract to work in the necessary timeframe and for the specific work required. The draft permit also has corresponding recordkeeping and reporting requirements to show compliance with this requirement. These requirements have all been retained in the final permit. Taking such steps to use OCS source vessels with the highest-tiered engines available at the time of contract, combined with the permit's additional requirement that the engine in these vessels meet requirements including Best Available Control Technology (BACT), Lowest Achievable Emission Rate (LAER), New Source Performance Standards (NSPS) in Part 60, Subpart IIII (NSPS IIII), and State of the Art (SOTA) emission standards, ensures that emissions are minimized as much as possible, given the limited information available at this time in the absence of existing vessel contracts.

Comment 2.2
The transportation and installation processes will likely involve substantial emissions from vessels and machinery, contributing to air pollution and greenhouse gas emissions.

Response 2.2
Emissions from transportation and installation will come from engines onboard vessels, powering machinery or the vessel itself (propulsion). The OCS permit establishes maximum daily and annual emission limits for pollutants from all the engines during the Construction & Commissioning (C&C) and Operations and Maintenance (O&M) phases of the project. The OCS permit contains permit conditions regarding choosing OCS source vessels with the highest-tier (cleanest, most efficient) marine engines available for the necessary timeframe and for the specific work required, to minimize air emissions (*see* Response 2.1). And, the OCS permit requires the Permittee to comply with BACT, LAER, NSPS IIII, and SOTA emission standards for marine engines onboard OCS source vessels.

Further, under the Clean Air Act's Prevention of Significant Deterioration of Air Quality (PSD) requirements at 40 C.F.R. § 52.21, the applicant is required to demonstrate that air quality impacts from emissions during the C&C phase, as well as during the O&M phase, are within (i.e., do not exceed) the National Ambient Air Quality Standards (NAAQS) and PSD Increments. Meeting NAAQS and PSD Increment requirements is intended to ensure that projects would not significantly cause or contribute to air quality worsening (i.e., would prevent significant deterioration) beyond certain levels set by the regulations. The air modeling analyses prepared by the applicant show that the project meets these PSD NAAQS and Increment requirements.

Comment 2.3
Commenter would like to stress the importance of contracting and utilizing vessels with the highest-tier engines as possible within each vessel category in order to achieve the highest possible fuel burning efficiency, and prioritizing the usage of ULSD [ultra-low sulfur distillate] fuel instead of residual fuel to reduce the emissions of air toxics or co-pollutants. We recommend significant and robust planning ahead of time in order to secure the high-tiered engine vessels for the C&C phase. Additionally, we also recommend this approach for the O&M phase.

Response 2.3
See Response 2.1 for an explanation on how contracting with vessels with the highest-tier engines available at that time and capable of doing the work necessary at the necessary time is addressed in the OCS air permit. This approach applies to contracting OCS vessels for use during both the C&C and O&M phases.

With respect to ULSD, the permit requires that all marine engines that are capable of burning ULSD with 15 ppm sulfur or less do so. However, there will be a small number of vessels with marine engines where the use of ULSD is not possible. In those few cases, they will burn Emission Control Areas (ECA) marine fuel with a sulfur content less than 1,000 ppm. For additional information on ECA marine fuel, *see* https://www.epa.gov/sites/default/files/2015-10/documents/420b14097.pdf.

Comment 2.4
According to EPA in the Fact Sheet at page 38, Atlantic Shores takes no responsibility for the air polluting emissions from marine vessels that it is procuring. "Atlantic Shores explained that it would be extremely costly to replace, retrofit, or upgrade leased vessels in order to use add-on pollution controls or implement inherently lower-emitting practices or design." That is an egregious dereliction of duty by both Vendor/Atlantic Shores and Regulator/EPA. Atlantic Shores must be held responsible for its machinery, or EPA should find another Vendor.

Response 2.4
EPA does not make individual vessel for hire selections for applicants. However, for OCS source vessels, the OCS air permit requires Atlantic Shores to hire the OCS source vessel with the highest-tier (i.e., cleanest, most efficient) engines available for the specific work needed in the timeframe needed. Atlantic Shores is not responsible for retrofitting/upgrading existing engines with add-on pollution controls for the vessels it decides to hire due to the high costs involved and the extended time it would take to retrofit them. Also *see* Response 2.1.

Comment 2.5
Commenter is concerned that with the unknown contracts for the actual vessels that will be used, the types of vessels and thus emissions are only estimates at this time. Therefore, there is a reasonable potential for more air pollution than publicly noticed.

Response 2.5
See Response 2.1. As discussed above, regardless of which actual vessels the Permittee hires, the OCS air permit requires that the OCS Facility as a whole meet daily and annual emission rates specified in the permit that are based on the applicant's representations in the air quality analysis that was provided. In addition, as discussed in Response 2.1 and elsewhere, the applicant is required to contract OCS source vessels with the highest-tier engines available at the time of contracting that can do the work required in the timeframe needed. And, regardless of the vessel contracted, the engines on all OCS source vessels and on the offshore substations (OSSs) have to meet the applicable LAER, BACT, NSPS IIII, and SOTA emission rates specified in the permit.

Comment 2.6
The permit gives Atlantic Shores the option of several representative vessel types typically used for similar offshore wind projects, or any other vessel or engine that meets the requirements in the permit, including but not limited to National Source Performance Standards (NSPS) Subpart IIII requirements, best available control technology (BACT) and lowest achievable emissions rate (LAER) requirements, and state of the art (SOTA) requirements. Similarly, the permit lists two potential types of non-marine engines that Atlantic Shores could use for the offshore substations, because the exact specifications for the engines are unknown.

Another justification for this approach is that Atlantic Shores will contract all the vessels it is using for the projects, so it will not have the right to retrofit or upgrade the vessels to incorporate the best possible emissions control technology. According to the permit application, waiting for vessel owners to make the upgrades themselves would result in project delays for Projects 1 and 2 as well as other offshore wind projects planned around the same time. While these approaches, along with monitoring and enforcement measures, may ensure that air emissions do not exceed the bare minimum the law requires, harmful air pollution should be minimized as much as possible if the technology exists to do so, regardless of the optimal equipment leasing schedule.

Response 2.6
As a clarification, Tables 1A and 1B in the permit indicating the representative vessel types and the representative non-marine engines, are the expected representative equipment that will be used in this project. Any additional equipment not listed in those tables are not allowed by the permit. For a discussion of permit provisions addressing minimization of vessel emissions, see Response 2.1.

With regards to non-marine engines for WTG and OSS installations and during operation of the OSSs, regardless of the final specifications of non-marine engines to be used, they will have to meet the 40 C.F.R. Part 1039 Tier 4 engine emission standards. The Tier 4 standards are the highest Tier standards in Part 1039, meaning they impose the most stringent limits currently in effect for non-marine engines, which apply to a range of pollutants. *See also* Response 2.5.

Section 3.0 – Environmental Justice

Comment 3.1
I am concerned about the potential negative impacts of the current project on the state's economy, commercial fisheries, and Environmental Justice (EJ) communities on the island. Specifically, I am inquiring whether the EJ community in southern Long Beach Island, NJ has been adequately considered. There are approximately 500 trailer homes occupied by permanent or year-round residents in this area. Has there been any engagement with these residents? Although I understand that the open comments are for the OCS air permit, I believe that the EPA should consider all relevant aspects.

Ultimately, I am seeking:

1. More information about this issue. While I support clean energy, the current messaging from BOEM and the EPA to our community has been lacking.
2. Engagement in this matter. I have valuable resources and would like to be involved in discussions.

This project could have severe consequences for the Jersey Shore, and I am deeply concerned about its potential impact on our community.

Response 3.1
To address the commenter's concern, EPA has run an EJSCREEN report for southern Long Beach Island in a 5 km radius, and no Environmental Justice (EJ) indices were identified to be over the 80th percentile for both state and national comparisons. In addition, the New Jersey Department of Environmental Protection has also confirmed to EPA that the mentioned community does not have known EJ concerns. However, if the southern Long Beach Island area were to have EJ concerns, the project's distance from the shore means the project would have no disproportionate impacts to the Long Beach Island area.

Executive Order 12898 directs federal agencies to identify and address communities at risk and implement environmental justice. To this end, BOEM's ROD outlines efforts to ensure such communities were considered. Page 66 of the ROD explains that "*[d]isadvantaged communities have been identified within the vicinity of the proposed project"* and the ROD contains maps of those identified communities. The ROD indicates that "*BOEM concludes that environmental justice populations would not experience disproportionately high and adverse effects related to construction, O&M, and decommissioning of onshore infrastructure.*"

With respect to the commenter's generalized concern about potential severe consequences for the Jersey Shore and impacts on commercial fisheries, which the commenter did not identify more specifically, BOEM's ROD contains conditions related to commercial fisheries and for-hire recreational fishing at Section 6, beginning on page 147 of 208. BOEM's FEIS also considers impacts to commercial fisheries. The protection of marine mammals falls under the jurisdiction of the National Marine Fisheries Services (NMFS).

Regarding the commenter's request for more information and engagement on the issue, BOEM's ROD requires Atlantic Shores to develop and maintain a website pertaining to the project. Per BOEM's ROD (page 77 of 208), the website must be updated monthly with construction updates and other publicly important information. Additionally, the website is a place for the public to leave comments pertaining to the project.

See Response 4.1 and 4.4 for links to BOEM's ROD and FEIS.
See Response 4.29 for concerns regarding the economy.

Comment 3.2
Residents in the overburdened communities (NJ law) and EJ communities (federal designation) of Atlantic City and neighboring Brigantine are already burdened with asthma. The construction and operation debris will disrupt their breathing and the quality of life for residents in these areas. EPA's EJScreen analysis on pp. 61-62 of the Fact Sheet is flawed and contradictory.

While “Atlantic City was found to be above the 80th percentile for three indices,” importantly, “if the area of interest exceeds the 80th percentile for one or more of the EJ indices, then EPA considers that the permitting action may have a high potential for EJ concerns that need to be addressed.” In fact, Atlantic City’s own Chelsea Condo Association, right in the epicenter of the proposed OSSs in Atlantic City, is shown to have 80-90% Asthma impacts on the EPA’s EJScreen Environmental Justice Mapping Tool. There are 16 Air Pollution Sites reporting to EPA within the defined area, an overwhelming number of polluted areas - not to mention the 6 Brownfields, 1 Toxic Release Inventory and 12 Water Discharges. It should be noted there are also 5 Schools and 1 Hospital that also stand to be impacted by the C&C and O&M within the defined area. The whole point of EJ mapping is to make sure that overburdened communities such as Atlantic City do not suffer disproportionate impacts due to their socioeconomic and impacted health status.

The Chelsea neighborhood may also be found on New Jersey’s overburdened communities.

Please take note that Brigantine is 4.5 statute miles and downwind from Atlantic City. Similarly, Brigantine has its own overburdened community.

Response 3.2

Both Atlantic Shores and the EPA have conducted environmental justice (EJ) analyses on potential impacts to overburdened communities from the proposed project. EPA has conducted an EJSCREEN report on Atlantic City in a 5 km radius to see if any areas would be identified as being above the 80^{th} percentile for state and/or national averages for at least one of EPA’s predetermined EJ indices. As noted by the commenter, the Fact Sheet accompanying the draft permit stated that Atlantic City was found to be above the 80th percentile for three indices. The high percentage of asthma is noted.

Air quality impacts from the project are highest at the project’s offshore site and diminish as the air emissions from the construction and commissioning phase approach the shoreline where potential EJ communities reside, and the air quality impacts will diminish further during the operations and maintenance phase. Additionally, because the project is located in the Wind Development Area, which is entirely located 7.6 or more nautical miles offshore and not in an overburdened community, it would not be subject to NJDEP’s Administrative Order 2021-25, which implements certain requirements of New Jersey’s EJ law at N.J.A.C. 7:1C. Note that the permit also contains BACT, LAER, and other requirements to limit the air emissions from the project.

EPA notes that outreach to leaders in these communities was conducted as part of the public comment process for this action, including contacting the local, state, and Congressional officials for Atlantic City (and Brigantine, discussed in this next comment) and asking them to share information about the public hearing and public comment period with their constituencies. EPA also notified local organizations that work on environmental justice issues and have expressed interest in this project in the past and asked them to share that information with their networks. Any input received from these organizations or the community were considered and are addressed in this Response to Comment document.

Please refer to Section XV ("Environmental Justice") on page 62 of the Atlantic Shores Fact Sheet that accompanied issuance of the draft permit to see more details on the EJ analysis done for the Atlantic Shores OCS project.

Comment 3.3
The Public Notice and Project documents, including Fact Sheet and Draft Permit, state that EPA must consider New Jersey law. Under the construction and maintenance of the Projects as described in the Public Notice and Fact Sheet, there are significant adverse air polluting and other horrible environmental effects, with the real possibility of serious violations. As such, the facilities described under the Public Notice and Project documents will act as major sources of air pollution and other emissions that run afoul of New Jersey law, in so many ways. For example: The Project neither avoids disproportionate impacts on the New Jersey state protected overburdened communities ("OBCs") of Atlantic City and neighboring Brigantine, nor does it serve a compelling public interest, when its known health and pollution effects are too high and others need to be further studied. In effect, the environment and its population will be irreparably harmed to build and service such a Project.

Response 3.3
The commenter does not specifically identify "the significant adverse air polluting and other horrible environmental effects" about which they are expressing concern, and how specifically the emissions from this project run afoul of New Jersey law. However, limiting the permitted project's emissions has been a priority throughout the permitting process, and the permit contains conditions intended to accomplish this. In addition, the air quality analysis provided as part of the permit application shows that the maximum daily and annual emissions that will result from the project meet Clean Air Act NAAQS and PSD Increment requirements. This ensures that economic growth will occur in harmony with the preservation of existing clean air resources, while protecting public health and welfare. *See* Response 2.2. The C&C and O&M phases of the project will result in air emissions, primarily from the marine vessels that are required for the construction and maintenance of the offshore components of the project. For a further discussion of the marine vessel emissions, *see* Section 2 of this document.

See Response 3.2 for explanation of the environmental justice screening that both Atlantic Shores and the EPA undertook, including the environmental justice analysis conducted for Atlantic City. Regarding the municipality of Brigantine, an EJSCREEN report was conducted in a 5 km radius around Brigantine, and one EJ index, "Drinking Water Non-Compliance," was found to be above the 80^{th} percentile for state and national levels. It is unlikely that the OCS project subject to the OCS air permit will have an impact on this EJ index level; in other words, the offshore construction, operation, and maintenance of the wind farms is unlikely to affect drinking water.

For additional discussion of the project's impacts on human and environmental health (such as air quality, water quality, economics, coastal fauna, and recreation), including considering impacts to any overburdened communities, *see* BOEM's ROD and FEIS. Links to the ROD and FEIS can be found in Responses 4.1 and 4.4.

Section 4.0 – Impacts on Marine Mammals, Ocean, Wildlife Environment, Tourism, Property Values, Noise, and Other Impacts

Many of the issues raised in the comments below are either outside the scope of this permitting action and/or fail to provide information sufficient for EPA to provide an informed response. EPA provides these responses for informational purposes only.

Comment 4.1
Although the permit seems to meet the Clean Air Act requirements, it should not be approved since the sonar mapping off the coast that is required for these projects is causing the slaughter of marine mammals such as whales, dolphins, porpoises, and marine reptiles such as sea turtles.

Response 4.1
The protection of marine mammals falls under the jurisdiction of the National Marine Fisheries Services (NMFS). *See* BOEM's Record of Decision (ROD) at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Atlantic%20Shores%20South%20ROD.pdf to review how the NMFS has addressed its responsibilities with respect to the protection of marine mammals and sea turtles. Section 5: Protected Species and Habitat Conditions starting on page 105 of 208 in the ROD contains conditions related to marine mammals and marine reptiles such as sea turtles. BOEM also discusses impacts to marine mammals and marine reptiles such as sea turtles in its Final Environmental Impact Statement (FEIS). *See also* Response 4.10. *See* Response 4.4 for a link to the FEIS.

Comment 4.2
These proposed 200 turbines that run on fossil fuels only 8.4 nautical miles from the beach is beyond unimaginable, to our Ocean, our wildlife, and our way of life.

The Project's wind turbines are already determined to be air polluting by EPA.

Response 4.2
The wind turbine generators (WTGs) being installed as part of this project will not run on fossil fuels. The WTGs will run on wind energy, and will use energy from the wind to generate electricity. EPA notes, however, that the offshore substations will have up to eight backup generators (one each) that will burn ultra-low sulfur fuel and will each operate no more than 500 hours/year. These backup generators will be used by the offshore substations for emergency power at those times, if any, when the connection to the grid is lost.

For issues related to the ocean and wildlife, and which other federal agencies with jurisdiction in these and other areas to address them, *see* Response 4.1. This response also has a link to BOEM's ROD.

Comment 4.3
These monopiles will destroy the Ocean floor with their football-sized concrete beds, and with that goes all the homes of our shellfish, clams, and crabs and our fisherman.

Response 4.3
Clams and crabs are both types of shellfish. Shellfish habitat protection is under the jurisdiction of the US Army Corp of Engineers and specific conditions related to shellfish can be found in Section 5.3.7.2. of BOEM's Record of Decision on pages 64 to 68 out of 208; shellfish impacts are also discussed in BOEM's FEIS. With respect to mitigating any impacts the project is expected to have on commercial fisheries and for-hire recreational fisherman, please see the implementation of the Direct Compensation Program also found in BOEM's Record of Decision. *See* Response 4.1 and 4.4. for links to BOEM's ROD and FEIS.

Comment 4.4
The EMF from underwater electrical cables is dangerous, poses serious health risks and will literally electrify our beaches and ocean floor when they are unearthed due to wear and tear, which is already happening in New England.

Response 4.4
Electromagnetic field (EMF) impacts from electrical cables are outside the scope of EPA's action on Atlantic Shores' OCS permit application under the Clean Air Act. For a discussion of the EMF impacts from underwater cables associated with this project and how they are addressed, *see* BOEM's Final Environmental Impact Statement (FEIS) at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/AtlanticShoresSouth_Vol1_FEIS.pdf.

Comment 4.5
Strongly opposed to any plans to industrialize our oceans. There have not been any long-term studies on the damage to our ecosystems, fishing industries, sea life, navigation difficulties, etc.

Response 4.5
These issues are outside the scope of EPA's action on Atlantic Shores' OCS permit application under the Clean Air Act. We note, however, that many of these issues are discussed and addressed in BOEM's FEIS and Record of Decision, *see* Responses 4.4 and 4.1, respectively, for the links to access these documents.

Comment 4.6
Not in favor of wind turbines on our oceans since they are dangerous to birds, whale migration and sea life. Also, noise pollution and ugly to look at.

Response 4.6
The issues raised by the commenter are addressed in the Record of Decision (ROD), such as in requirements for the applicant to develop and submit for approval a Bird Perching Deterrent Plan (ROD, page 109 of 208); a plan to minimize impacts to marine mammals (ROD, page 128 of 208, among others); and to use noise abatement systems (ROD, page 133 of 208) during all foundation pile-driving in a manner that achieves the maximum noise attenuation levels practicable. *See* Response 4.1 for the link to access the Record of Decision. Also, *see* Response 8.1 for an additional response on noise and *see* Response 10.5 for additional response on wind turbine visibility from shore.

Comment 4.7
Offshore wind is an abomination and disaster for our oceanic ecosystem. The damages will forever be felt.

Response 4.7
Please refer to BOEM's Final Environmental Impact Statement and Record of Decision for discussion of the project's possible impacts, including on the ocean's ecosystem, and how they are being addressed. *See* Responses 4.1 and 4.4 for the links to access these documents.

Comment 4.8
Opposed to any ocean wind farm along the East Coast. Industrialization of our ocean is good for nobody and does not change the carbon emissions. All it is doing is wrecking a natural resource and killing everything that lives in it. It is not clean or clean energy.

Response 4.8
Regarding the ocean ecosystem *see* Response 4.7. Regarding carbon emissions, *see* Responses 4.23 and 4.28.

Comment 4.9
Commenter provides a copy of certified resolution passed unanimously by the Borough of Seaside Park's governing body at its recent July 18, 2024 regular public meeting. Commenter describes the resolution as expressing some of the many issues that the commenter states have never been subject to an adequate scientific investigation, or a realistic cost-benefit analysis, as to the negative effects upon the environment, costs and fees imposed upon ratepayers and taxpayers. Commenter states that one of the most outrageous inadequately researched aspects of such massive industrialization off the coast concern the fact that the cumulative impact of such industrialization will condemn the North Atlantic right whale to extinction.

Response 4.9
For responses to specific items in the Borough of Seaside Park's resolution, *see* Responses 4.10, 4.25, 4.26, 4.27, 4.28, and 4.30.

Comment 4.10
Studies establish that the testing, construction, and operation of the Industrial Offshore Wind Project, though sold as green energy, has and will significantly damage the environment. There is little doubt it has and will continue to negatively impact the behavior of marine fish and mammals, including causing confusion, compelling them to swim ashore, and preventing them from diving and feeding (since the start of sonar surveying and seismic testing an unprecedented number of marine mammals have washed ashore and died). There is also no question it will cause significant environmental and wildlife damage onshore.

Response 4.10
It is not clear how these comments pertain to this permitting action. In addition, the commenter did not include or identify any specific recognized studies to support the above statements. BOEM's FEIS and ROD include discussions of potential impacts on marine mammals, and requirements relate to mitigating impacts; the ROD discussion begins on page 105 of 208, under Section 5: Protected Species and Habitat Conditions. *See* Responses 4.1 and 4.4, including for

links to the FEIS and ROD documents. In addition, according to the National Oceanic and Atmospheric Administration (NOAA) Fisheries website, "there are no known links between large whale deaths and ongoing offshore wind activities" and "[a]t this point, there is no scientific evidence that noise resulting from offshore wind site characterization surveys could potentially cause whale deaths." *See* https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/frequent-questions-offshore-wind-and-whales.

Comment 4.11
Numerous attempts to spread misinformation concerning a correlation between whale necropsy findings and offshore wind development are being "fueled" by fossil fuel industries and their political proponents. The greatest threat to marine life is climate change. As ocean surface temperature continues to rise, (now at its highest since initial records), food sources for marine mammals have moved closer to the coastline. The likelihood of becoming entangled in fishing gear or being in the path of cargo ships increases as these mammals search for their food.

Response 4.11
This comment lacks specificity and it is not clear how the comment pertains to this permitting action. Please refer to BOEM's Final Environmental Impact Statement and Record of Decision for discussion of the project's possible impacts, including on the ocean's ecosystem, and how they are being addressed. *See* Responses 4.1 and 4.4 for the links to access these documents.

Comment 4.12
Research has shown that wind farms act as artificial reef systems and may improve fishing. Whale strikes are more likely caused by boat strikes. How many whales will we kill with oceans that are too warm to sustain their food sources.

Response 4.12
This comment lacks specificity and it is not clear how the comment pertains to this permitting action. Please refer to BOEM's Final Environmental Impact Statement and Record of Decision for discussion of the project's possible impacts, including on the ocean's ecosystem, and how they are being addressed. *See* Responses 4.1 and 4.4 for the links to access these documents.

Comment 4.13
The University of Rhode Island showed that since mammals use the natural Electric and Magnetic Fields, EMF-s changes were detected in their behavior. The risk varies greatly by species.

If anyone responsible for this project has any environmental impact studies, to the contrary, please disclose. Again, where is the transparency?

Response 4.13
It is not clear how these comments pertain to this permitting action. Further, the commenter does not specifically identify the research they cite such that EPA can identify it with certainty.

However, an online search for the study identified by the commenter resulted in the following link, which may be the information referenced by the commenter[1]:

https://web.uri.edu/offshore-renewable-energy/ate/how-do-electromagnetic-fields-affect-marine-animals/

According to the article at the URI link, some marine species may have both magnetoreceptive and electroreceptive physiology. However, it appears that no conclusions resulted from the study other than "more research is needed to determine: 1) how species encounter and perceive cable EMFs throughout their lifetime and 2) how cable EMFs are present to marine species and vary with cable properties. Advancing this knowledge base will require a multidisciplinary approach and stakeholder involvement."

As far as we are aware, no one has provided to EPA any additional research related to the issue raised by the commenter. BOEM discusses EMF, including impacts on marine mammals, in the FEIS. *See* Response 4.4 for a link to BOEM's FEIS. *See also* Response 4.1 and 4.10 for additional discussion of impacts on marine mammals.

Comment 4.14
Not only does it pain me to think of the animals and marine life that have been and will be affected by this project (mysteriously many dead animals washing ashore while testing was being done apparently means nothing to anyone involved) but the fact that it will absolutely ruin the appeal of Long Beach Island that we all know and love.

Response 4.14
See Response 4.10.

Comment 4.15
What's to become of the fishermen that make their living off of the sea here when you disturb the entire ecosystem?

As an environmental protection agency, you should be doing just that - protecting the environment, not destroying it for offshore wind that's been proven ineffective. Not to mention the climate of NJ. When the turbines fill with ice, what will you use to de-ice them? Chemicals. Filling the ocean and poisoning the wildlife.

Response 4.15
See Response 4.3 regarding fishermen. As a result of this comment, EPA asked Atlantic Shores about any possible use of de-icing chemicals on the turbine blades. Atlantic Shores responded that it does not anticipate the use of de-icing chemicals on the wind turbine blades, and as such, it was not discussed in the Final Environmental Impact Statement (FEIS) or Record of Decision (ROD). Therefore, the use of de-icing chemical is not allowed by the ROD.

Comment 4.16
The project will adversely affect the citizens' livelihood on-shore communities near the water, vessel traffic, water quality, property values, and even human enjoyment of the coast.

---

[1] The URI link in turn references an article in Oceanography magazine, *available at* https://tos.org/oceanography/article/the-interaction-between-resource-species-and-electromagnetic-fields-associated-with-electricity-production-by-offshore-wind-farms.

Response 4.16
Expected and possible impacts from the project of the types raised by the commenter are discussed and addressed in BOEM's Final Environmental Impact Statement and the Record of Decision. *See* Responses 4.1 and 4.4 for the link to these documents.

Comment 4.17
The noise that the turning of the blades produces is well documented in many illnesses as the root cause for the unfortunate people that live near these monstrosities.

Response 4.17
Although the commenter does not identify any specific documentation, EPA assumes that the commenter is referring to reports of some type related to noise produced by wind turbine projects on land unrelated to this project. The wind turbine generators from this project that will be nearest to shore will be located approximately 7.6 nautical miles (8.7 statute miles) from the NJ shoreline. At this distance, it is unlikely for any noise from the turbine blades to be heard by communities onshore.

Comment 4.18
These foreign developers have no accountability for their maintenance and have and will pose National Security risk by interfering with radar and sonar. They also violate the FAA regulations for height requirements.

Response 4.18
This comment is outside the scope of this permitting action under the Clean Air Act. However, we note that the application states that Atlantic Shores is a 50/50 joint venture between EDF-RE Offshore Development, LLC (a wholly owned subsidiary of EDF Renewables, Inc.) and Shell New Energies US LLC. *See* BOEM's Record of Decision for discussion of the protection of national security of the United States related to the project. The Construction and Operations Plan (COP) submitted by Atlantic Shores for BOEM's review indicates the project will meet all Federal Aviation Administration (FAA) requirements for aviation and radar interference. To the extent the commenter is concerned about air emissions resulting from maintenance of the offshore wind farms, such maintenance for the project will be subject to emissions limitations and other requirements under this OCS air permit.

Comment 4.19 (2,
Commenter supports the project because of many reasons such as cutting our fossil fuel reliance, achieving the necessary carbon emission reductions to protect our communities from the climate crisis (e.g., severe rain, sea level rise, devastating hurricanes, and other extreme weather events), creation of new jobs, stable new source of tax revenue, etc.

Response 4.19
Commenter did not raise a specific issue that requires a response by EPA.

Comment 4.20 (4,
Please consider the recent events with Vineyard 1 blade catastrophe as a gauge for the future of NJ with any offshore wind installations. This power plant barely made it 6 months before it

failed leaving a trail of shrapnel in its wake.

Response 4.20
These issues are outside the scope of EPA's action on Atlantic Shores' OCS permit application under the Clean Air Act. We note that this issue appears to be limited to a certain number of defective blades from the GE Vernova turbine equipment supplier, which was used for the Vineyard Wind 1 project. Atlantic Shores has announced its selection of Vestas as their preferred turbine equipment supplier for Project 1. *See* https://atlanticshoreswind.com/atlantic-shores-selects-vestas-as-preferred-turbine-supplier-for-its-1-5-gw-project-in-new-jersey/. Atlantic Shores has not yet announced a preferred turbine equipment supplier for Project 2.

On July 17, 2024, the Bureau of Safety and Environmental Enforcement (BSEE) issued the following statement on this issue:

> *Following the July 13, 2024, blade failure incident at Vineyard Wind, BSEE has issued a Suspension Order to Vineyard Wind to cease power production from all its wind turbine generators until it can be determined whether the blade failure affects any other VW turbines. The Suspension Order suspends power production on the lease area and suspends installation of new wind turbine generator construction: Those operations will remain shut down until the suspension is lifted. BSEE has also issued a Preservation order to safeguard any evidence that may be relevant to determining the cause of the incident. As of this date, there are no reported injuries or harm to any marine resources or mammals from the incident. BSEE is onsite with Vineyard Wind as investigations are underway. BSEE will conduct an independent assessment to ensure the safety of future offshore renewable energy operations.*

Comment 4.21 (14,
Commenter urges EPA to implement a no action alternative and to impose an immediate moratorium as to the pending joint application for further offshore wind turbine pre-construction or construction activities off of New Jersey coast. At the very least, an immediate moratorium on this industrialization of the ocean should be imposed while an ongoing independent investigation by the Government Accountability Office (GAO) is being conducted. It is inevitable that such a study and audit by this congressional watchdog will recommend further scientific research and a more comprehensive and independent cost-benefit analysis as to the hazards and irreparable harm posed by the Atlantic Shores combined project and the similar massive industrialization projects of other wind turbines proposed to be located in the Atlantic Ocean, in a major hurricane and northeast storm zone, off New Jersey's precious shores.

Response 4.21
EPA is obligated under the Clean Air Act (CAA) to make a final permit decision (grant or deny) on a submitted permit application within one year of the determination that the application is complete. If the proposed facility would violate the provisions of the PSD or nonattainment New Source Review regulations, EPA must deny the permit. If it meets the applicable requirements, EPA must issue the permit. A no action alternative (i.e., not acting on a complete permit application) is not an option under the CAA. While the commenter expresses generalized concerns regarding the impacts of this project, it does not identify specific harms that EPA may

address here. EPA notes that BOEM's Record of Decision and BOEM's Final Environmental Statement, referenced in Responses 4.1 and 4.4, both discuss BOEM's consideration of a no action alternative for this project. To the extent the commenter seeks an immediate moratorium on all offshore wind development, this comment is beyond the scope of the current permitting action. To the extent this comment seeks investigation by the Government Accountability Office, this comment is also outside the scope of this permitting action. With respect to the cumulative impacts of this project and other wind farm projects, *see* Response 5.18.

Comment 4.22 (14,

The entire process is flawed, and there has been inadequate review and investigation as to the cumulative direct and indirect impacts of this massive industrialization proposed off of New Jersey. There exists extreme danger for irreparable harm to our environment, the recreational and commercial fishing industries, our tourism industry, and the very nature, character, and history of the Jersey shore.

Response 4.22

For information on how EPA addresses cumulative impacts from various wind farms, *see* Response 5.18. Also *see* Responses 4.1 and 4.4.

Comment 4.23 (14,

As BOEM itself has acknowledged and admitted in its final environmental impact statement for the equally reckless and less massive wind turbine project of Vineyard Wind, "Overall, it is anticipated that there would be no collective impact on global warming as a result of off wind project...."

As if any further proofs were needed as to the foolish nature of proceeding with such environmentally devastating and overwhelmingly costly projects, the July 13th incident involving the catastrophic failure of one of the Vineyard Wind turbine blades underscores the emergent need to implement an immediate moratorium and pause on this rubber-stamped fast-tracked massive industrialization of our precious ocean. As you should be aware, the devastating aftereffects of the washup of the non-biodegradable shards of the blade have shut down six Nantucket, Massachusetts beaches and have caused untold and incalculable financial and environmental costs and impacts. This incident occurred on a virtually windless day and not even during a storm event.

Response 4.23

Each individual wind farm project has its own individual Final Environmental Impact Statement. Therefore, the FEIS for Vineyard Wind is not the same as the one for this project. A link to the FEIS for this project can be found in Response 4.4. The FEIS (page 557 of 560) states that BOEM anticipates that the long-term benefits of this project include that it will reduce greenhouse gas emissions, that one of the benefits of the project is:

> *Promotion of renewable energy to help ensure geopolitical security, reduce GHG emissions to combat climate change, and provide electricity that is affordable, reliable, safe, secure, and clean[.]*

Similarly, BOEM's ROD (page 50 of 208) states:

> *The Projects will help both the United States and New Jersey achieve their renewable energy goals, diversify the State's electricity supply, increase electricity reliability, and reduce greenhouse gas (GHG) emissions.*

Also, *see* Response 4.20 for additional information on the blade incident in Massachusetts.

Comment 4.24 (21,
How do you expect people to rent on an island where you have offensive wind turbines gaping the shoreline. You will crush the tourism here that the island is built on. No one wants to look out at a vast and beautiful ocean dotted with horrendous wind turbines. Not to mention how close they will be to shore.

Response 4.24
The issues raised by the commenter do not fall under the purview of the Clean Air Act. For issues related to tourism and the economy, *see* Response 4.39. Regarding visual impacts, *see* Responses 4.25 and 10.5.

Comment 4.25
The Industrial Offshore Wind Project turbines include up to 300 massive wind turbine structures (each as high as 1000 ft+ and as wide as 900 ft+). The closest turbine structures will be located approximately 8.5 miles from the coast and clearly visible to residents and tourists who live or travel to the Shore for the environment, unspoiled views, and way of life.

In 2006-2008, when the areas were designated for offshore wind energy, proposed tower heights were approximately 200 to 400 feet and rotor diameters were under 328 feet. By analogy, when the plan was hatched essentially 300 single-family houses were to be built at the Shore and it is now a proposal for a cityscape comprised of 300 immense and imposing skyscrapers.

Response 4.25
The OCS permit allows the construction and operation of up to 200 offshore wind turbine generators, not 300. Regarding the commenter's concerns regarding the visibility of the wind generator structures onshore, these are addressed on page 59 of BOEM's Record of Decision (ROD), which states the following:

> *The primary detriment of implementing this project is the immutable visibility of the structures, especially in combination with other planned facilities in the vicinity. The offsetting benefits to economics, energy need, environmental integrity, and offsetting land-based energy production outweigh that detriment and reflect a long-term investment in the needs and welfare of the people.*

See Response 4.1 for a link to BOEM's ROD.

Moreover, although the proposed project will be visible from shore at certain times, this visibility will often be limited due to atmospheric conditions. In fact, the FEIS concludes that at the closest analyzed Key Observation Point (KOP), turbines would only be visible for approximately half of the year.

Further discussion on the visibility of the project can be found in the FEIS, *see* Response 4.4 for a link to the FEIS, and in Section 5.0 of Volume II of the Atlantic Shores Offshore Wind Construction and Operations Plan (COP), including proposed environmental protection measures to effectively reduce the potential visual impacts as practicable given the nature of the technology and the location of the project. For a copy of the COP submitted by Atlantic Shores, *see* https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/AtlanticShoresSouth_Volume%20II_AffectedEnvironment_05-01-2024_rev1.pdf. The full Visual Impact Assessment included as Appendix II-M1 of the COP is *available at* https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/2024-05-01_Appendix%20II-M1_VIA.pdf.

For additional discussion regarding the Coastal Zone Management Act (CZMA), *see* Response 10.5.

Comment 4.26
An independent analysis concludes that the cost of the Industrial Offshore Wind Project will exceed $100 billion and raise electric customer rates by 55% for residential customers, 70% for commercial customers, and 85% for industrial customers. For context, in 2024 wholesale power purchase prices are roughly $55 dollars per megawatt-hour, whereas the Board of Public Utilities recently approved contracts for offshore wind with a price of $144 per megawatt-hour. In addition, the costs associated with transmission upgrades to distribute the electricity are forecast to increase progressively from $1 per megawatt-hour to roughly $40 per megawatt-hour by 2047.

Response 4.26
This comment regarding the cost of electricity is outside the scope of EPA's action on Atlantic Shores' OCS permit application under the Clean Air Act. EPA also notes that the commenter did not provide or identify the independent analysis mentioned.

Comment 4.27
Studies establish that the Industrial Offshore Wind Project will convert a pristine public natural and economic resource into a mammoth industrial eyesore in exchange for a catastrophic loss in tourism revenue, jobs, and property values, and, therefore, will be a significant economic burden imposed upon all State residents. A 2024 study prepared by Tourism Economics, an Oxford Economics Company ("Oxford Report"), establishes that the Offshore Wind Project will cause losses for the Long Beach Island municipalities of approximately 835,000 annual visitors, $450.2 million in tourism spending, a total economic impact (loss) of $668.2 million, and a total loss of State and local tax revenue of $80.3 million. Studies further show at least 25% of beachgoers would switch beaches to avoid the visual blight cause by the Industrial Offshore Wind Project. Moreover, as admitted by the federal government, the fishing industry will be diminished by the resultant navigational hazards, habitat conversion, fish aggregation, migration disturbances, and space-use conflicts.

Response 4.27
See Response 4.39 for concerns regarding tourism and the economy.
See Response 4.1 for concerns regarding the fishing industry.
See Responses 4.25 and 10.5 for concerns regarding visual impacts.

Comment 4.28
Studies support the conclusion that the Industrial Offshore Wind Project will not reduce global warming or CO_2 emissions. In fact, Harvard University found that the installation of scores of wind turbines in concentrated areas will actually raise surface temperature, especially in the immediate area of the turbines. The Harvard researchers concluded "[t]he direct climate impacts of wind power are instant, while the benefits of reduced emissions accumulate slowly. If your perspective is the next 10 years, wind power actually has - in some respects - more climate impact than coal or gas." Further, the Oxford Report establishes that offshore wind energy production is the most expensive form of renewable energy produced on a large-scale.

Response 4.28
The commenter does not identify with specificity the research being referenced. It appears the commenter may have intended to reference and quote from a *Harvard Gazette* news story available at https://news.harvard.edu/gazette/story/2018/10/large-scale-wind-power-has-its-down-side/. The article references two papers published by Professor Keith and by Lee M. Miller, *Climate Impacts of Wind Power*, 2 Joule 2618 (2018) and *Observation-Based Solar and Wind Power Capacity Factors and Power Densities*, 2018 Environ. Res. Lett. 13 104008[2]. Both papers examined aspects of onshore wind power generation unrelated to the emission of air pollutants from such projects.

The comments and research raised by the commenter, which concern climate and other impacts of wind energy, are outside the scope of this permitting action. Under Clean Air Act section 328, Congress mandated that EPA regulate air pollution from OCS sources. Implementing regulations at 40 C.F.R. Part 55 outline the OCS air permitting program. EPA is issuing this OCS air permit because it meets those requirements and contains the air emissions limitations and related requirements necessary pursuant to the Clean Air Act and its implementing regulations.

Comment 4.29
Our government is more worried about the money they will make than the environment and economy they are responsible to protect.

Response 4.29
EPA's role is to ensure that the proposed project meets all applicable Clean Air Act requirements. The Clean Air Act does not regulate the issues raised by this commenter. For concerns regarding the economy, page 23 of BOEM's ROD states the following:

> *Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities,*

[2] This article was later corrected by Lee M Miller and David W Keith, *Corrigendum: Observation-based solar and wind power capacity factors and power densities*, 2019 Environ. Res. Lett. 14 079501 ("An error in the estimate of wind plant area led us to underestimate wind power densities by about 40%.").

> *would be **minor adverse** and **moderate beneficial**. The beneficial impacts would primarily be associated with the investment in offshore wind, job creation and workforce development, income and tax revenue, and infrastructure improvements*.

See Response 4.1 for a link to BOEM's ROD. Also*, see* Response 4.39.

Comment 4.30
The sole conclusion is that the Industrial Offshore Wind Project is designed to be funded by all State residents and businesses, significantly higher electricity rates and significant loss of jobs and tax revenue, will cause environmental and wildlife devastation will irreparably damage the tourism, fishing industries, and overall State economy in the form of higher overhead energy costs, will not produce actual green energy. and the State's residents will be left to pay for the removal of or live with the massive, decaying turbines. Indeed, if it is built, the State's residents will trade their priceless and pristine natural and hard-earned economic resources for a significantly higher cost of living and significantly lower quality of life and environment, and, incredibly, without the purported green energy benefits.

Response 4.30
Commenter expresses generalized concern about the environmental, economic, and wildlife impacts of this project. The comment is not specific enough to enable EPA to respond. However, EPA notes that EPA's role in this proceeding is to ensure that the proposed project meets all applicable Clean Air Act requirements. The remainder of this comment both lacks specificity *and* is outside the scope of the Clean Air Act. However, regarding the project's funding, EPA notes that, as stated in the application, Atlantic Shores is a 50/50 joint venture between EDF-RE Offshore Development, LLC (a wholly owned subsidiary of EDF Renewables, Inc.) and Shell New Energies US LLC, two private entities. EPA also notes that, with regards to employment and economics, page 59 of BOEM's ROD states the following:

> *The Project is designed to meet in part the need for competitively priced renewable energy and additional capacity in accordance with State and regional renewable energy demands and goals. Under the New Jersey Offshore Wind Development Act (OWEDA), the NJBPU is required to establish an OREC program requiring a percentage of electricity sold in the state be derived from offshore wind energy, in order to support at least 7,500 MW of generation from qualified projects. On June 30, 2021, the NJBPU selected the Atlantic Shores Offshore Wind South project to develop the offshore wind energy facilities proposed in these applications. In terms of the private need, in addition to providing financial gain to the companies investing in the project, the final EIS indicates that the project would have a minor beneficial impact on employment and economics.*

For information on how this project meets the Clean Air Act, *see* Response 2.2.
For additional comments on the economy and tourism, *see* Response 4.39.
For comments on fishing impacts, *see* Response 4.1.
For funding of the decommissioning phase, *see* Response 8.3.

Comment 4.31
I wish to express my support for the Permit, provided that Atlantic Shores Offshore Wind Project 1, LLC follows all environmental guidelines as laid out in the Permit documentation. I believe that the resulting emissions, which will not violate National Ambient Air Quality Standards, are acceptable in exchange for the clean energy that the offshore wind projects will provide to the State of New Jersey upon their completion. The Atlantic Shores projects are crucial to helping NJ reach its clean energy goals, and aside from the environmental improvements that will come from the generation of clean offshore energy, the projects will doubtless create jobs and bolster NJ's clean-energy economy.

Response 4.31
EPA appreciates the commenter's support of the proposed action. For additional discussion of the economy and tourism, *see* Response 4.39.

Comment 4.32
I fully support and am an advocate for offshore wind development, in particular, the proposed Atlantic Shores Offshore Wind Projects 1 &2. Transitioning now to clean, renewable energy is a necessity if we hope to survive the climate crisis. NJ coastal communities and states across the entire Northeast have continued to experience severe flooding, rising sea level, eroding coastlines, hurricanes and other extreme weather conditions because of our reliance on fossil fuels as our energy source. "Natural" gas plants are anything but that. They are methane plants, 85 times more potent than CO_2 after it is released into the atmosphere with 93% of that heat being absorbed by our oceans. We know that climate events seriously impact our economy. According to a climate assessment group, E2, climate-related disasters have cost NJ $59 billion dollars since 1980. Already major homeowners' insurance companies are deciding not to sell new homeowners policies because of the catastrophic risks caused by climate change. The severity and frequency of these storms puts a strain on utilities and of course on the health and safety of our overburdened communities.

Response 4.32
EPA appreciates the commenter's support of the proposed action and although this comment does not require a response, EPA notes that the project's purpose and need for the project, as provided by the applicant and reviewed by the US Army Corp of Engineers, "will help both the United States and New Jersey achieve their renewable energy goals, diversify the State's electricity supply, increase electricity reliability, and reduce greenhouse gas emissions." *See* BOEM's ROD at page 50 of 208. Comments related to insurance companies are beyond the purview of this permit. For additional comments on the economy, *see* Response 4.39.

Comment 4.33
We have the unique advantage of being a coastal state, ideal for utilizing wind power. The wind projects will generate enough clean electricity to power millions of homes and create thousands of new jobs thereby significantly boosting NJ's economy. Time is running out. It is the height of irresponsibility **not** to recognize a climate emergency both for ourselves and future generations. We must move off fossil fuels now and invest in the clean, renewable energy of offshore wind.

Response 4.33
This comment does not require a response from the EPA.

Comment 4.34
We need more renewable energy sources to meet our (mandated state) goal of 35 percent of the electricity sold in the state to come from renewable sources by 2025. Wind farms are an inexhaustible source of renewable energy and will also create jobs. I don't think wind farms a mile offshore will be visible on most days and will not impact tourism at the shore, except when I boycott Ocean City and Cape May for their selfish behavior and short-sighted politicians. According to the New York Times recent article: The state consumes more power than it produces within its borders and imports electricity from nearby states through the regional grid.

Response 4.34
This comment does not require a response from the EPA, except to clarify that the lease area for this project starts about 7.6 nautical miles (8.7 statute miles) from the New Jersey shore.

Comment 4.35
I urge the EPA to approve the Air Quality permit for the Atlantic Shores Offshore Wind Project on a timely schedule without delay. I acknowledge that there will be some short-term air pollution from fossil-fuel-powered boats and construction vehicles. However, I expect that this will only be for the first year or so. After construction is complete the only source of air pollution will be yearly maintenance. This project is planned to operate for at least ten years. The Atlantic Shores Wind Project will be a key step forward in moving the state of New Jersey from fossil fuel powered electricity to clean, non-polluting renewable energy. Long term, it will be good for air quality.

Response 4.35
This comment does not require a response from the EPA. As a point of clarification, the application states that construction of the project is expected to last about two years and the operation and maintenance (O&M) phase of the project is projected to last up to 30 years.

Comment 4.36
It is egregious to me that EPA thinks it is okay to run a 6400-megawatt cable past our homes and schools. People say they are for the project, tell them the cable is going past their house and see how they feel then. It should not be done until the communities are guaranteed they are safe.

Sea Girt Army camp has been chosen as the location for the cable reaching land. It is not a large field, instead it is a small area where children have sporting events and the State Troopers train located in between residential neighborhoods. The BPU does not even guarantee that is where the cable is going. In spring, I spoke to the men testing the soil on Sea Girt’s side of the fence. What about the state endangered birds that have been sighted in that area? The children who play at the little league field and in the army camp? The families who live on the cable route? There has to be a better way.

Response 4.36
The OCS air permit does not regulate the onshore components related to this project. It only regulates offshore activities regulated by section 328 of the Clean Air Act. However, we note

that the total expected output from the Atlantic Shores project (Project 1 & Project 2) is designed to be approximately 2,840 MW.

Comment 4.37
Sea Girt is home to only one of four maritime forests (Crescent Park) that are in New Jersey. It is 17 acres and is located only one block from the beach. It is home to countless species; it is the only bird migratory stopping place from Sandy Hook to Long Beach Island. Shouldn't we take more time to study the effects that pile driving our seabed and the air pollution that the construction phase will create?

Response 4.37
The permit contains terms applicable to air emissions from the C&C phase of the project. An environmental analysis of the project (including components subject to the OCS air permit, as well as components such as onshore components that are outside the scope of the OCS air permit) has been conducted by BOEM, including analysis of air impacts and impacts on birds and other wildlife. *See* Response 4.4 for a link to BOEM's FEIS. *See* Responses 4.42 and 4.6 for discussion regarding bird impacts. *See* Response 4.1 for a link to the ROD.

Comment 4.38
The wind turbines and the power cables both create HEAT.

According to wind-watch.org, buried cables for offshore turbines can generate enough heat to raise the temperature of the surrounding ocean sediments by as much as 20 C degrees within 1.2-2 ft of the cable. The more power generated through the offshore turbines, the more energy generated is transferred through the cables coming on land. Do we really want to start heating our streets now with 6400 megawatts of power?

A Harvard study published in the academic journal, Joule, stated that wind turbines cause significant local increase in surface temperatures where they are located. The heat exchange from turbines' cooling systems can increase localized water temperature. Wind turbines also cause local temperature increases on the surface and pull-down warmer air from as far as 1,640 feet, warming the surface of the earth! This impacts, people, plants, and animals living near the turbines. Mammals and fish that like warm water are drawn to the area around the cables. When 'cold pools' come in, they are shocked. Need I say more? The more power generated through the offshore turbines the more energy generated is transferred through the cables.

Response 4.38
It is not clear how this comment pertains to this permitting action. *See* Response 4.54 regarding concerns about cables transmitting heat. *See, e.g.,* Responses 4.1, 4.3, 4.10, and 4.55 regarding impacts on wildlife. *See* Response 4.28 regarding the Harvard study.

Comment 4.39
How do you expect people to rent on an island where you have offensive wind turbines gaping the shoreline. You will crush the tourism here that the island is built on. No one wants to look out at a vast and beautiful ocean dotted with horrendous wind turbines. Not to mention how close they will be to shore.

Response 4.39
This comment is outside the scope of this permitting action. For concerns regarding tourism, page 27 of BOEM's Record of Decision (ROD) states the following:

> *The Proposed Action would result in* ***minor adverse*** *and* ***minor beneficial*** *impacts on recreation and tourism. Adverse impacts are primarily due to anchoring, land disturbance, lighting, cable emplacement and maintenance, noise, traffic, and the presence of structures. Beneficial impacts are primarily due to the presence of structures and the potential for the artificial reef effect.*

See Response 4.1 for a link to BOEM's ROD.
See Responses 4.25 and 10.5 regarding visibility and distance to shore and the CZMA.

Comment 4.40
One of the most significant concerns of this project centers on the potential use of the Sea Girt National Guard Training Center as a location in which wires would enter the land. The specific area in which they would reach land fall is a designated area for the endangered Piping Plovers. The NJDEP has purportedly sought to protect this endangered species in this area in which they nest. The disruption that will be caused in bringing these wires on shore will eclipse any activities that the NJDEP has previously expressed concerns over or prohibited.

Once they have cut through the beach to install these wires, there are proposals to run the wires and conduits underground but through the Borough streets. The Borough strenuously objects to this. Our infrastructure and access to that infrastructure could be adversely impacted by this proposal and similar proposals. Moreover, this would be highly disruptive to the citizenry living nearby.

Response 4.40
This comment concerning impacts from onshore construction is outside the scope of this OCS air permit. *See* Response 4.36.

Comment 4.41
Recently, we've seen firsthand what can happen if there is an issue or damage to a turbine. Beaches in the Nantucket/Matha's Vineyard area have been shut down due to fiberglass on the sand and debris from the turbine. In addition, there is the possibility of oil being discharged into the ocean if a turbine is damaged.

Have the possible long term and long reaching effects of these proposed offshore wind farms been sufficiently studied?

Response 4.41
See Response 4.20 regarding comments on the Nantucket incident.

The wind turbine generators will not have any oil-storing equipment, although the offshore substations will have some oil-storing equipment. As per page 81 of 208 of BOEM's ROD, an Oil Spill Response Plan (OSRP) must be submitted to the Oil Spill Preparedness Division

(OSPD) of a federal agency called the Bureau of Safety and Environmental Enforcement (BSEE) for approval before any installation of oil storage or handling equipment on the Outer Continental Shelf. *See* Response 4.1 for a link to BOEM's ROD.

Comment 4.42
There are studies which the turbines can change the air pressure with the rotation of their blades causing birds to collide with them.

Response 4.42
The commenter did not include or identify any specific recognized studies to support the above statements. This comment is also outside the scope of this permitting action under the Clean Air Act. However, EPA notes that BOEM's Record of Decision requires the project to have plans to minimize adverse effects to birds, including a bird perching deterrent plan. The ROD also requires that, to minimize collisions, every 5 years the project must create a review of best modern technologies to prevent bird collisions and present it to BOEM for approval.

Comment 4.43
There is also some evidence that the turbines may affect ocean creatures such as dolphins and whales.

Response 4.43
The commenter did not include or identify any specific recognized studies to support their statements, and it is not clear how this comment pertains to this permitting action. However, for concerns regarding marine life, *see* Responses 4.1 and 4.10.

Comment 4.44
This project can affect recreational and commercial activities.

Response 4.44
This comment is outside the scope of this permitting action under the Clean Air Act. *See* Response 4.39 for recreational concerns and *see* Response 4.29 for economic concerns.

Comment 4.45
These Industrial Utility Electric Power Plants contain hundreds of thousands of gallons of fossil fuel petrochemicals subject the North Atlantic corrosive saltwater environment suspended above our Ocean less than 9 miles from our beaches and homes. As we have seen with the closure of the beaches in Nantucket, these Industrial Offshore Wind Turbine Power Plants are machines that can and will fail. It is a matter of fact these will leak and spew fossil fuel petrochemicals into the air and water.

Response 4.45
Fuel bunkering to supply ultra-low sulfur diesel (ULSD) fuel (or marine fuel, if necessary) for use by ships will be available during the Construction and Commissioning (C&C) phase, expected to last up to two years. The safety aspects of this process are well documented in the public domain. Portable diesel generator engines to be used temporarily to provide energy during the commissioning of the wind turbine generators (WTGs) and offshore substations (OSSs) in

the project's C&C phase will also use ULSD. During the Operations and Maintenance (O&M) phase, the application and permit outline use of up to 8 OSS permanent generators running on ULSD to be located on the OSSs and used during storms and when electrical connection to the grid is lost. All emissions from these generators were considered as part of this CAA permitting process, and the permit contains conditions related to these engines to require their compliance with the CAA. Each permanent generator will have its own 8,500-gallon ULSD fuel storage tank. The permit contains conditions to limit air emissions from the engines and tanks using or storing ULSD (or marine fuel). During the O&M phase of this project, the WTGs will not contain any fossil-fuel power engines. To the extent the comment relates to water impacts, it is outside the scope of this OCS air permitting action under the Clean Air Act.

See Response 4.2 for more information on the OSS generators.
See Response 4.20 for comments regarding the Nantucket project.
See Response 4.41 for comments regarding possible oil spills.

Comment 4.46
The construction and maintenance of up to 200 wind turbines, along with the associated offshore substations and inter-array cables, pose significant environmental risks. These include harm to marine ecosystems and wildlife, disruption of marine habitats, and increased underwater noise pollution, which can negatively impact marine mammals and fish populations.

Response 4.46
This comment lacks specificity and it is not clear how these comments pertain to this permitting action.

See Responses 4.1, 4.3, and 4.10 regarding marine ecosystems and underwater noise pollution.
See Response 4.4 regarding inter-array cables.

Comment 4.47
There is a risk of hazardous material spills during the construction and operational phases, which could further degrade air and water quality in the region.

Response 4.47
The commenter does not clearly identify which materials cause the expressed concerns. To the extent the commenter is concerned about potential oil spills, *see* Response 4.41. To the extent the commenter is concerned about the potential release of SF_6 gas, *see* Section 1.0 of this Response to Comments.

Comment 4.48
The cumulative impact of these activities could outweigh the environmental benefits of the renewable energy produced. Therefore, a thorough environmental impact assessment and consideration of alternative solutions with lower ecological and air quality impacts are essential before granting any certification.

Response 4.48
See Response 4.4 for a link to BOEM's Final Environmental Impact Statement (FEIS). In the FEIS, a total of 21 alternatives were considered. Of these, 5 action alternatives and the No Action Alternative went through a detailed analysis. After analysis by the Department of the Interior, the Preferred Alternative (or "selected alternative") was determined to allow for OCS renewable energy development while protecting human, marine and coastal environments. The bottom of page 39 of 208 of BOEM's ROD (*see* Response 4.1 for a link) relays the reasons why this alternative was selected:

> *The final EIS found that the selected alternative would result in fewer impacts than other action alternatives considered and is consistent with the purpose and need.*

Comment 4.49
I oppose these wind projects because they pose an extreme threat to marine wildlife and the habitat on which the fish and mammals depend. The threat to birds is also foremost in my mind.

Response 4.49
This comment lacks specificity and it is not clear how the issues raised by this comment relate to this permitting action.
See Responses 4.1, 4.3, and 4.10 for comments on marine wildlife.
See Responses 4.42 and 4.6 for comments on birds.

Comment 4.50
There is no level of exposure to air pollution such as NO_2 and particulate matter that avoids health impacts. The release of air pollutants could also affect marine water quality when pollutants are deposited into the environment. Further, the onshore components of the project are expected to impact some vegetation—a risk that is only addressed in the Fact Sheet and not in the draft permit. The permit must fully address vegetation impacts as required by law. Otherwise, EPA cannot approve it. Allowing avoidable environmental impacts to occur defeats the purpose of Projects 1 and 2, whose stated purpose is to benefit the environment.

Response 4.50
The final modeling submitted meets all of EPA's requirements, and emissions in either of these phases (C&C or O&M) will not cause or contribute to any violations of the NAAQS or PSD Increment. While the Clean Air Act's PSD regulations do not require EPA to assess the impacts of pollutant deposition to the ocean, they do require analysis of emissions impacts to vegetation and soil, and the impacts to vegetation from pollutants such as NO_2, $PM_{2.5}$, PM_{10}, and CO were addressed in the modeling. Table 9 of the Fact Sheet shows that all of the maximum predicted air pollutant concentrations for the project (onshore or offshore) are below the threshold for impacts to vegetation. The permit includes limits on the OCS Facility's daily and annual pollutant emission rates to ensure that the emission rates used in the air modeling analysis are not exceeded.

The purpose of the Atlantic Shores Offshore Wind Project is to develop a source of renewable energy to the Northeastern United States, helping both the U.S. and New Jersey achieve their renewable energy goals and reduce greenhouse gas emissions. The project will also create new employment opportunities. The highest annual emissions generated by this project will be during the C&C phase (2 years), with lower annual emissions expected and allowed during the 30-year O&M phase that follows the C&C phase. The majority of the project's timeline will consist of these lower annual air emissions. The terms contained in this permit are intended to ensure that the project air emissions are in compliance with the CAA, including measures as appropriate limiting those emissions.

EPA notes that BOEM considered alternatives, including a no action alternative, to prevent adverse environmental impacts. *See* Responses 4.1 and 4.4 for links to BOEM's ROD and FEIS. BOEM's Record of Decision explains that, ultimately, the preferred alternative limited adverse environmental outcomes while still allowing for the generation of renewable energy.

Comment 4.51
The wind farms in question are to be constructed at a distance numbering less than 8 miles from the coastline and will be visible to residents from the shore. Tourism within the communities of the New Jersey Atlantic coastline, particularly what is termed the "Jersey Shore," is a significant contributor to the state's economy, enabling both small and large businesses in the area to thrive, which helps to nurture the healthy economic environment of New Jersey. Placing these wind farms at the proposed distance from the shoreline will create a public eyesore and produce a detrimental effect upon New Jersey's tourism and overall fiscal health. Most current offshore wind farms are recommended to be placed at a distance near 25 miles offshore- outside of public view. Allowing this project to be constructed distanced at less than 8 miles offshore is imprudent.

Response 4.51
The Atlantic Shores project, at its closest, will be 7.6 nautical miles (8.7 statute miles) from shore. There are a lot of considerations that go into determining the locations of offshore wind farm leases. Regarding BOEM's process for establishing offshore wind energy leases, *see* Response 10.1. *See* Responses 4.25 and 10.5 for discussion of visibility impacts. For a response regarding tourism and economy concerns, *see* Response 4.39.

Comment 4.52
The drilling and land disruption could potentially cause problems with the old buildings and high rises that are not structurally sound in Atlantic City.

Response 4.52
This comment is outside the scope of this permitting action under the CAA. The OCS air permit regulates air emissions from pile driving in the lease area. However, it is highly unlikely that seabed vibrations caused by pile driving will travel 7.6 nautical miles or more to cause problems to the buildings in Atlantic City. To the extent this comment is expressing concern regarding any drilling or land disruption occurring onshore as a result of construction of the cable landing sites and/or other necessary onshore infrastructure, such onshore work is not within the scope of this OCS air permit. To the extent federal, state, or local permitting or other requirements apply to onshore work, the applicant would be required to comply with such requirements.

Comment 4.53
Demolition work during the construction phase ("C&C") will certainly have air polluting effects, according to the Project's own documents, and will require additional impact analyses according to the Fact Sheet on pp. 59-61.

Response 4.53
EPA is not aware of demolition work at the site of the OCS Facility to be conducted during the C&C phase. However, air emissions from the OCS Facility during the C&C phase, including from OCS source vessels and marine and non-marine engines, are addressed by the terms of this permit and were evaluated as part of air quality analyses and modeling submitted as part of the application, reviewed, and discussed in the Fact Sheet. Page 59 of the Fact Sheet (available at https://www.epa.gov/system/files/documents/2024-07/atlantic-shores-ocs-fact-sheet-july-11-2024_0.pdf and in the docket number EPA-R02-OAR-2024-0312 for this action at http://www.regulations.gov) states the following:

> *EPA concludes that the emissions in either of these phases will not cause or contribute to any violations of the NAAQS or PSD Increment, and Atlantic Shores has satisfactorily met the ambient air quality impact requirements of the PSD regulations.*

For additional in-depth discussions of the various modeling and air analyses conducted for this project, *see* Section 5.0. To the extent the commenter is referred to any demolition work that may occur onshore for constructing infrastructure to deliver the electrical power generated by the offshore wind farm, such onshore work is outside the scope of this OCS air permitting action.

Comment 4.54
We also have concerns regarding the impact of transmission cables on the subaqueous environment. Moreover, the potential impacts on ambient temperature from increased water temperatures coming from many miles of "hot" transmission wires running from the clusters to the shores should be considered. Has an analysis been done of this impact? It is bad enough that these cables will be trenched through Essential Fish Habitat (as defined in the Magnuson–Stevens Fishery Conservation and Management Act). Has it been determined what impact the swath of cable running many dozens of miles underwater will have on the water temperature along the route? It has been argued that water temperatures are increasing, yet it is proposed that this massive length of cable will run underwater before being trenched through a beach in which endangered and threatened species' breeding grounds are located. Is there an impact on ambient temperature, and water temperature, that will exacerbate the claim that our ocean water temperatures are increasing?

Response 4.54
EPA notes that, for wind farm projects, the US Army Corps of Engineers (USACE) designated BOEM as the lead federal agency for complying with the consultation requirements of Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), 16 U.S.C. § 1801 *et seq.,* regarding Essential Fish Habitat. EPA, in the interest of efficiency and consistent with federal law, also designated BOEM as the lead federal agency to ensure compliance with the MSFCMA. BOEM consulted with the National Marine Fisheries Service (NMFS) on USACE's behalf. BOEM and USACE reached an agreement regarding the analysis of Essential Fish Habitat conservation recommendations provided by NMFS which are listed on

Page 64 of 208 of BOEM's ROD. The conservation recommendations do not include the issue of heat from buried cables raised by the commenter. *See* Response 4.1 for a link to the ROD.

BOEM has published a white paper discussing heat from buried transmission cables, which can be accessed at https://www.boem.gov/sites/default/files/documents/renewable-energy/studies/Transmission_Cable_Heat_WhitePaper.pdf. The white paper discusses that heat transferred through a cable or other object will be transferred through the sea water until the temperature balances out and reaches thermal equilibrium. Because of the ability for water to absorb heat, the amount of heat generated from transmission cables is not enough to create a discernable change in ocean temperature.

See Responses 4.1, 4.3 and 4.10 for additional discussion of marine wildlife impacts.

Comment 4.55
An honest analysis of the impacts on migratory waterfowl, Puffinus species, and other migratory birds that fly at night over the ocean between New Jersey and New York needs to be performed. While not all of this falls under the purview of the EPA, this agency should assure the appropriate agency addresses these concerns vis a vis the impacts of massive turbines. We ask the EPA to do a thorough and honest analysis of the environmental impact of these turbine clusters and, where appropriate, ask the appropriate agency to address the issue.

Response 4.55
The Clean Air Act does directly address the commenter's concerns. However, EPA, in the interest of efficiency and consistent with federal law, designated BOEM as the lead federal agency for this project to ensure compliance with the Endangered Species Act (ESA), 16 U.S.C. § 1531 *et seq.* BOEM has conducted an environmental impact analysis for the project, including impacts on birds, and addresses bird impacts in its ROD. *See* Responses 4.42 and 4.6 for further discussion regarding bird impacts, and Responses 4.1 and 4.4 for links to BOEM's ROD and FEIS. As discussed in section 5.2 of the ROD, an Avian and Bat Post Construction Monitoring Plan (ABPCMP) will be developed by the Lessee with input from the New Jersey Department of Environmental Protection, US Fish and Wildlife Services, and other interested parties. Annually, throughout the O&M phase the Lessee is required to complete and submit an Annual Monitoring Report that includes data, analyses, and summaries of ESA and non-ESA birds and bats. Following the report, the Lessee will meet with BOEM, BSEE, and USFWS within 30 days to discuss the results. If adjustments to the ABPCMP plan are deemed necessary, the Lessee must comply.

Comment 4.57
We believe the EPA has the obligation, and ability, to consider the direct emission impacts of the turbine clusters caused by commercial and recreational fishing vessels, as well as coastal and international ships, being forced to take protracted routes to circumvent clusters. So, for example, commercial and for-hire fishermen have long pointed out that the turbine clusters will force them to take protracted routes to offshore fishing grounds to circumvent the clusters. Likewise, for many (e.g., clam, scallop and finfish fishermen) the clusters' locations will limit access to certain grounds and force those vessels to take more circuitous routes to other grounds, thereby forcing them to burn more fuel while seeking to produce food for consumers and access

recreational opportunities. It fails to adequately address the long-term impacts of turbine cluster locations on the vessel routes, as well as coastal and international ships. In summary, these clusters will force vessels to run further, burn more fossil fuels, add to the cost of food and other products to U.S. consumers, and impact air quality.

Response 4.57
Impacts on travel routes for fisherman are outside the scope of this OCS air permit. However, EPA notes that page 27 of BOEM's Record of Decision states that "It is important to clarify that approval of the Project would not limit the right to navigate or fish within the Project Area." The ROD also discusses impacts to vessel traffic, and while it notes various adverse impacts related to fishing and navigation, it also states at page 26 of the ROD:

> *The project-specific Navigation Safety Risk Assessment (NSRA) shows that it is technically feasible for mariners to navigate through the Project...The NSRA involves several analyses including a detailed assessment of existing vessel traffic in the Project area, a review of the characteristics of the existing waterways, an analysis of meteorological and oceanographic (metocean) conditions affecting navigation, and an evaluation of historical search and rescue activity in the region...All the structures will be placed east-northeast to west-southwest and spaced 1.0 nm [nautical mile]and north to south spaced no less than 0.6 nm apart to align with the predominant flow of vessel traffic. Atlantic Shores consulted with USCG [US Coast Guard] and the fishing industry on the grid layout to minimize the project effects to navigation safety, and SAR [search and rescue] operations for the Project area.*

Comment 4.58
Commenter would like to work with those entities implementing the project to ensure this project is designed to prioritize minimal impact on our residents who have been largely ignored up to this point. State leaders, who commenter understands to have primary purview over the on-land transmission, have not addressed essential issues in a transparent and thorough manner, including:

- Health and safety
- Impact to our infrastructure and environment
- Tertiary costs to taxpayers

Studies regarding electromagnetic fields (EMF) have shown increased risk of cancer, including childhood leukemia. Many experts suggest such high-power cables be at least 200 meters (660 feet) from homes, yet these cables are proposed to be as close as 25-50 feet from Sea Girt, Manasquan, Wall and Howell homes and schools.

Response 4.58
The issues raised by the commenter related to on-land electrical transmissions are outside the scope of this OCS air permitting action under the Clean Air Act. This OCS air permit relates to the offshore Atlantic Shores Project OCS Facility, not the onshore infrastructure. For a discussion on EMF impacts to marine species, *see* Responses 4.4 and 4.13.

Section 5.0 – Dispersion Modeling Analysis

The air quality modeling analyses supporting this permit demonstrate that construction and operation of the proposed source would not cause or contribute to a violation of any NAAQS or PSD increment under any conceivable construction or operating scenario that may occur under the terms and conditions of the permit. Since there will be variability in exactly how, when, and where the permit-specific construction and operation activities will be conducted by the permit applicant, the modeling is based on conservative assumptions that are intended to reflect a level of activity that is as high or higher than what could reasonably be expected to occur over the relevant period of time. Such a "worst case" approach is intended to project a higher-level of air quality impact than any impact that could be expected under the terms and conditions of the permit; this approach is used in order to ensure protection of the NAAQS and PSD increment at all times under anticipated meteorological conditions. Each of the modeling parameters described in the responses that follow in this section reflect a level of activity and emissions that reasonably approximate such worst-case air quality impacts, considering the nature of the project described in the permit application and supplementary information, and the terms and conditions of the permit.

Comment 5.1
The construction schedules are not consistent among EPA's OCS air permit, BOEM, and NMFS. In the OCS permit, there is a construction of 141 turbines to be fully installed in one year. BOEM has a construction schedule of 100 turbine foundations in one year. The OCS air permit application should have been based on the 200 anticipated turbines for projects 1 and 2.

Response 5.1
The application states that construction of the project is expected to take less than two years, which is consistent with what the commenter indicates is BOEM's assumption of 100 of the 200 turbines being constructed each year. However, in order to ensure that even in a worst-case (i.e., highest emissions-per-year) scenario that the project subject to the OCS air permit would not result in annual NAAQS and increment standards being violated, analyses performed for these purposes assumed that, at most, 141 turbines would be constructed in a single year. The annual modeling conducted for these purposes modeled emissions for 3 years (using meteorological data from 2018-2020), and for each of those three years made the same assumption that the same 141 turbines and 4 offshore substations would be constructed (the emissions associated with annual construction for the turbines are represented in AERMOD modeling files as WTG_V1-WTG_V141; offshore substations are represented in AERMOD modeling files as OSS_V1-OSS_V4). Modeling the same construction as if it were occurring in three different years was meant to capture what the project's impacts would be during the worst-case meteorology year.

Comment 5.2
As shown in Table I–1 of the OCS air permit application, wind turbine foundation installation for projects 1 and 2 is only separated by a year. Since the 24-hour air quality standards and increments are based on a 3-year average, the additional 60 turbines should have been modeled. Absent such explanation it appears that they have not.

Response 5.2
Unlike the modeling and air quality analyses conducted for purposes of analyzing compliance with annual NAAQS and increment requirements, the modeling and air quality analyses conducted to determine the project's compliance with short-term NAAQS and increment standards (i.e., 1-hour, 8-hour, and/or 24-hour standards) did not assume that 141 turbines would be constructed in a year. Instead, in order to ensure that modeling for the short-term standards represented a worst-case scenario (i.e., for this purpose, the highest emissions per 1-hour, 8-hour, or 24-hour period), the modeling assumed that all sources of emissions from all activities that would occur during construction were occurring simultaneously and continuously for 3 years (i.e., 24 hours a day, 365 days a year, for 8760 hours per year or 8784 hours per year in a leap year). The modeling used meteorological data for the 3-year period between 2018-2020, in order to ensure compliance with the short-term standards even if the highest impacts occurred in the worst-case meteorological conditions over that period. The emission sources were also modeled as if they were all placed in the northwest corner of the lease area, closest to the coastline of New Jersey and the Brigantine National Wilderness Area, to represent maximum possible onshore impacts.

The commenter's concern that 60 turbines were left out of modeling is not relevant to the short-term NAAQS and increment modeling since, as discussed above, construction activities were modeled as occurring continuously. EPA notes, however, that construction of 141 turbines in one year is a worst-case scenario (Atlantic Shores has represented that 141 turbine installations reflects the highest possible amount of activity that may occur in one year based on the schedule presented in the OCS air permit application). To ensure worst-case scenario modeling, annual NAAQS and increment modeling assumed construction of 141 turbines in a year for multiple years, which adds up to more than the 200 total turbines covered by this permit, and thus accounts for the 59 turbines not included in the first year of construction. *See* Response 5.1 for additional discussion of annual NAAQS and PSD increment modeling.

Comment 5.3
On a monthly basis the uniform installation rate of the air quality modeling scenario is not consistent with the BOEM and NMFS schedules. It would place 56 turbines foundations into the seabed from June through September, but the BOEM and NMFS schedules call for 75 installations during that period. This can underestimate impact at the Brigantine National Wilderness Area because summer conditions are likely to be more conducive to higher received concentrations there.

Response 5.3
Modeling to ensure the project would meet short-term NAAQS and increment standards used conservative assumptions, *see* Response 5.2. Construction activities were modeled as if they occurred continuously, 24 hours per day, throughout the entire year to ensure that worst-case emissions and meteorological conditions were captured. If construction were conducted at that pace, it would result in construction at a pace of about 20 foundations installed per month (*please see Response 5.4* for a more detailed discussion of foundation installation schedule), and approximately 80 foundations could be installed during the four-month period of June through September. This ensures that the impacts at Brigantine National Wilderness Area were not underestimated. However, nothing in the permit requires that construction be conducted at this speed, and the nature of worst-case assumptions are such that it is not expected that construction

will in fact occur at this pace.

Comment 5.4
Commenter questions foundation installation schedules used for other environmental reviews.

The estimate of 2.6 days per foundation installation provided by the permitting contractor, Epsilon Associates, in support of the air permit in its letter to the EPA of October 28, 2022 raises serious questions about the foundation installation schedules that have been assumed for the BA [Biological Assessment], BO [Biological Opinion] and the environmental impact statement (EIS).

Those schedules assumed 201 turbines installed over 2 years. They are based on specific monthly numbers in the Jasco Applied Science Underwater Acoustic Impact Assessment Report of 10 August 2022 in Appendix B, Table 3. That schedule assumed, over a two-year period, that 35 foundations could be installed in June, 45 in July, 37 in August, 32 in September and 29 in October for a total of 178 installations. But based on the Epsilon 2.6 days per foundation number only 11 can be installed in one month, or 110 turbines foundations in 2 years over that five-month period.

This leaves a deficit of 68 turbines foundations not accounted for in the Jasco schedule. About 20 of those might be accommodated in December (2 years) where little installation is currently shown, but this still leaves a deficit of 48 turbines foundations. At a rate of 11 foundation installations per month, the construction schedule for the BO, BA and final EIS would have to extend at least four months into spring and summer of the third year, which raises issues regarding the Take estimates in those documents and the basis for the BO.

Response 5.4

On March 29, 2023, Atlantic Shores submitted to EPA a memo entitled "3.4.1 Atlantic Shores Modeling Memo 3 7 2023 EPA" with information regarding the days of construction for heavy emitting activities; this updated the October 28, 2022 submittal and the memo is included in the docket for this permitting action. On page 6 of the memo is the following table:

Table 1
Days of Actual Construction versus Proposed Modeled Days of Construction

Heavy Emitting Activity	Days of Actual Construction at a Single Position	Proposed Modeled Days at a Single Position
Foundation Installation (B02)	1.5 days	365 days (possibly avoiding Time-of-Year restrictions)
WTG Installation	2.6 days	365 days
Pre-lay Cable Preparation	< 1 day	365 days
Inter-array Cable Installation	1.1 days	365 days
OSS Installation	5 Days	365 days (possibly avoiding Time-of-Year restrictions)
Scour Protection	0.5 Days	365 days

As the table indicates, a foundation installation is expected to take 1.5 days, and a WTG installation is expected to take 2.6 days. If the foundation installation takes 1.5 days, then an average of 20 foundations can be installed in a month. Atlantic Shores' application represents that the foundation installation rate of 1.5 days is a conservative estimate representing a slow rate of installation, and the actual rate could vary based on several factors, including weather conditions. For example, weather conditions in July are typically more favorable for vessel activities and are likely to enable a quicker rate of installation.

At a rate of 20 foundations per month, it would require 10 months to install 200 foundations. This duration of 10 months for WTG foundation installations is listed in Table 1-1 on page 19 of 460 of the permit application.

EPA notes that, although it was not directly raised by the commenter, the table above indicates that, *after* a WTG foundation is installed, a conservative estimate representing a slow rate of installation would be that a WTG installation (installing the topside of the WTG on top of the foundation) would take 2.6 days per installation. At such a rate of installation it would take 17 months to install 200 WTGs. EPA is not aware that limitations on the timing of such installations apply as they do to the installation of the WTG foundations. It should also be noted that WTG foundation installations and WTG topside installations can happen simultaneously for different WTGs. This is because one vessel can install a foundation at one location while a different vessel installs a WTG in another location where the foundation has already been constructed. And as previously stated, the modeling reflects these two construction activities occuring simultaneously.

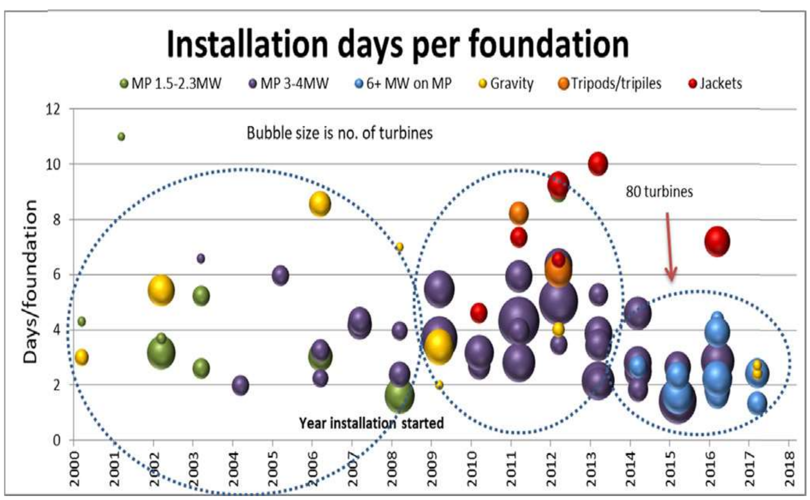
Comment 5.5
The Air Permit Application has Unrealistic and Realistic Foundation Installation Rates.
The application does not present a clear statement of and justification for a daily and yearly foundation and wind turbine generator (WTG) installation rate. This is important because it determines the number of years required for construction which directly affects the averaging done for the 24-hour PM2.5 increment over the 3-year period.

Table I–1 of the application states a project foundation installation of 10 months or 300-day duration and a three-year construction period. Assuming that 300 days applies to the 141 segmented turbine project that is a rate of 2.1 days per foundation. The air permit modeling speaks to a "peak" year of 141 turbines installed, without regard to seasonal restrictions or a rate of 2.6 days per turbine.

These rates are clarified in a letter from Epsilon Associates to EPA Region II of October 28, 2022 stating that "**foundation installation** would take 62.05 hours (or **2.6 days**) and wind turbine generator **(WTG) installation another** 35.5 hours (or **1.5 days**) to complete installation at each position". According to that letter these two activities result in the higher PM2.5 emissions.

The Epsilon Associates estimate of 2.6 days for foundation installation is supported by real world experience with installation times as shown below.

Figure 1



Overall picture of the time taken to install one foundation (without the turbine) for each OWF that has finished foundations installation.

Source: Offshore wind installation: Analysing the evidence behind improvements in installation time, Roberto Lacal-Aránteguia, José M. Yustab, José Antonio Domínguez-Navarrob a Joint Research Centre, European Commission, Petten, The Netherlands Department of Electrical Engineering, Universidad de Zaragoza, Spain.

As shown, the installation time for smaller 6-megawatt (MW) turbines on monopile foundations has leveled out at one every two days. It can only take longer for the larger diameter foundations here for the 15 MW turbine foundations here.

For those foundations, the two days per foundation is low because the steel surface area being driven into the seabed increases significantly for the larger turbines foundations here as opposed to the 6 MW turbines shown above.

The foundation being driven is a hollow cylinder of given diameter and shell thickness. The shell is making contact with the seabed. For the 6 MW turbines the foundation diameters are typically 7.5 to 8 meters (26 feet) with a shell thickness of 3.26 inches. The 15 MW turbine foundations here are 15 meters (50 feet) with a shell thickness of approximately 6 inches.

The circumference area being driven into the seabed for the 15 MW foundations is approximately 12.3 $ft.^2$ as opposed to 3.6 $ft.^2$ for the 6 MW turbine, or 3.5 times as much. This is the area offering resistance to the pile driver. It is therefore reasonable to assume that it will take about three times as long to pile drive one of the 15 meter diameter foundations, as opposed to the 7.5 to 8 meter diameter foundations in the chart above.

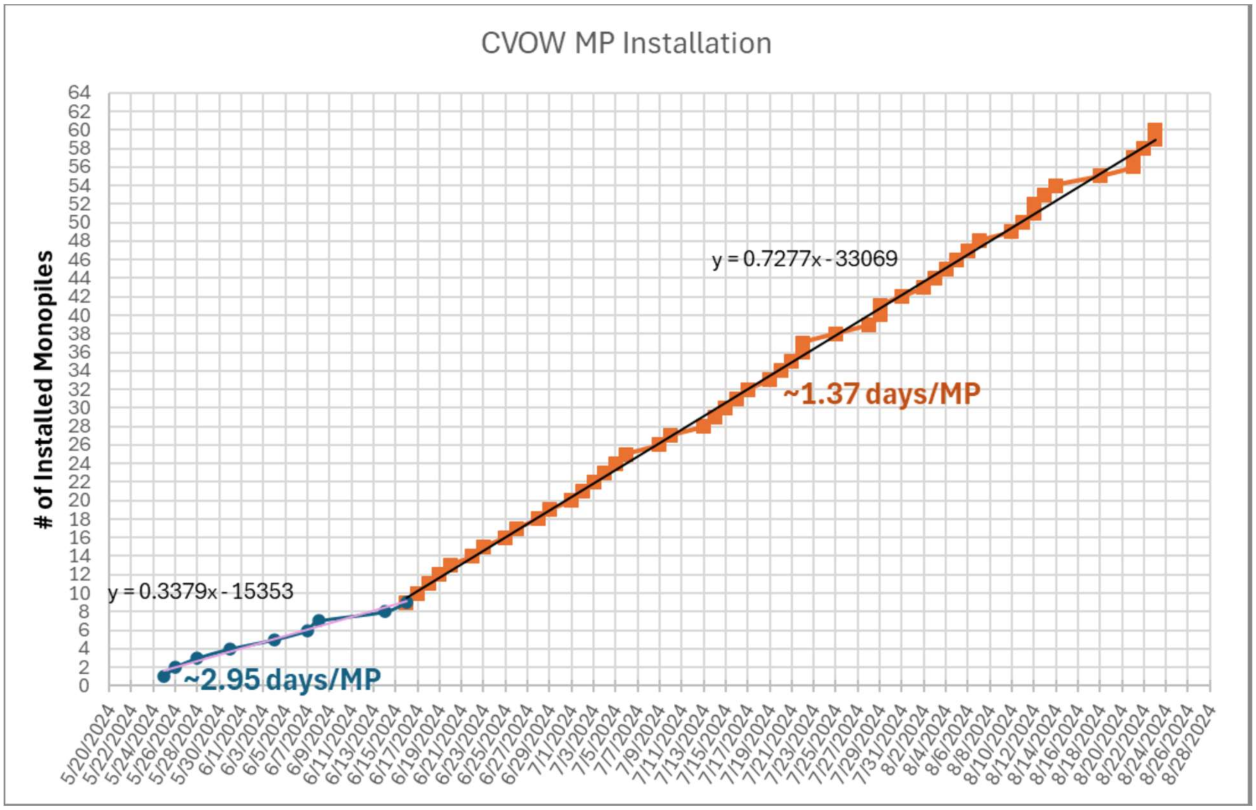
This is confirmed by BOEM and Jasco Applied Science data. In its supplemental information for the Vineyard Wind 1 project Biological Assessment of May 11, 2020, the BOEM stated in table 4.1-1 that the time to pile drive a 7.5 meter diameter foundation was about three hours. In its August 10 report, Appendix B, Table 1, Jasco estimates the time required to pile drive a 15-meter monopile foundation at 8.6 hours, or about three times as long.

Considering the increased pile driving time, and longer times for other foundation construction activities for the larger monopiles, the calculation of the 24-hour increment at the [Brigantine Wildlife Area] requires averaging the yearly 98th percentile numbers well into the 3-year period. This permit application has apparently and improperly considered only one year of higher construction emissions and concentrations, and averaged that with two years of lower emissions.

Response 5.5

On March 29, 2023, Atlantic Shores submitted updated information regarding the estimated days of construction for the foundation installation and WTG installation. Based on this submittal, foundation installation is expected to take 1.5 days per foundation, and WTG installation is expected to take 2.6 days per WTG. This distinction is important, as pile driving is associated with the foundation installation. *See* Response 5.4 for a more detailed discussion of foundation installation schedule.

In response to this comment, EPA sought supplemental information from Atlantic Shores, and Atlantic Shores reiterated that 1.5 days per foundation is the best estimate and the 2.6 days per foundation is not reflective of their best estimate. Atlantic Shores provided a real-world example with a similar value for a similar project, although it noted that foundation installation times can be variable. The Coastal Virginia Offshore Wind Project (CVOW), which is currently under construction off the coast of Virginia with similar monopile and transition piece foundations, has made announcements indicating that they started foundation installation on May 22, 2024, and had installed their 50th turbine on August 12, 2024, which is a pace of about 1.65 foundations per day. Atlantic Shores noted this includes installation of the first foundations, which it would expect to occur at a slower rate due to required extensive sound field verification and normal installation ramp-up. Following the initial startup period, the installation pace at CVOW has been about 1.4 days per location. This information has been made public via the United States Coast Guard District 5 Local Notice to Mariners (LNMs). Atlantic Shores provided the figure below documenting the dates of foundation installation.



The commenter raises concern about the averaging done for the 24-hour $PM_{2.5}$ increment. As discussed in Response 5.2, for short-term standards such as the 24-hour increment, construction emissions from all sources and for all activities were modeled continuously using three years of meteorological data and worst-case assumptions about source locations. For the 24-hour Class I $PM_{2.5}$ increment, compliance with which is assessed at the Brigantine National Wilderness Area, the standard is not averaged over a 3-year period, but rather the modeled concentrations of $PM_{2.5}$ at each receptor for each year are reviewed to ensure that the 24-hour $PM_{2.5}$ increment for a Class I area is not exceeded at a given receptor more than once per year (the "2nd-high"). This "2nd-high" value is examined for all three years modeled to ensure that the highest "2nd-high" value over the 3-year period (also referred to as the "high-2nd-high") does not exceed increment requirements. The number of years across which construction is conducted does not impact this analysis because of the conservative assumptions described above that assume all sources operate at all times, every day. In supplemental information provided by Atlantic Shores, Atlantic Shores indicated that while a shortened timeframe for foundation installation could impact the actual hourly emision rate in either direction depending on the circumstance, in general a shorter installation period will almost always correlate to lower total emissions, and Atlantic Shores used load factors from established references and based on project team experience.

The yearly averaging referred to by the commenter is instead conducted in the analysis to ensure compliance with the 24-hour $PM_{2.5}$ NAAQS, not the 24-hour $PM_{2.5}$ increment. This analysis identifies, for each modeled receptor, the day during each modeled year with concentrations of $PM_{2.5}$ in the 98th percentile; in practice, this turns out to be the day with the 8th-highest concentration in a given year for a given receptor. This 98th percentile value for each of the three years are then averaged together, and this average cannot exceed the 24-hour $PM_{2.5}$ NAAQS. And again, the number of years across which construction is conducted does not impact this analysis because of the conservative assumptions described above that assume all sources operate at all times, every day.

For additional discussion related to the 1-hour NO_2 NAAQS standard, *see* Response 5.7.

Comment 5.6 (10,
The Air Permit Application is Ignoring Real World Monthly Constraints on Pile Driving

The air permit application has ignored the real-world constraints on pile driving imposed by its sister agencies.

It has assumed a uniform foundation installation rate throughout the year. But the NMFS Biological Opinion only allows pile driving from May through November.

The air permit application states that it modeled air quality concentration at the [Brigantine Wildlife Area] throughout the year to be conservative, but this is not likely to be the case since more stable atmospheric conditions conducive to higher modeled concentrations at the shore, are more likely in the summer rather than the winter. Therefore, the air permit application should have modeled construction activities only for those mostly spring and summer months.

The air permit application has not stated the number of hours per day required to pile drive one foundation. That duration can be an important factor in calculating the 24- hour concentrations at the BWA. Depending on that number, there may also be a need to maintain pile driving at night to adhere to annual construction schedules, as discussed further below.

Response 5.6
The application acknowledges the time of year restrictions on pile driving. In Table 1-1, on page 19 of 460 of the permit application, note "C" states:

> *The expected timeframe depends on the foundation type. If piled foundations are utilized, pile-driving will follow a proposed schedule from May to December to minimize risk to North Atlantic Right Whale. No simultaneous pile driving is proposed.*

As previously mentioned, construction activities were modeled throughout the entire year as if all emitting activities were conducted every day, to ensure that the effects of the worst-case emissions during worst-case meteorological conditions were captured; given these assumptions, modeling winter months would not impact the emissions modeled for summer months. In addition, for the short-term NAAQS and increment standards, construction activities such as pile driving were modeled as work conducted during each hour, all 24 hours of the day, to ensure that all possible air impacts were captured regardless of when during the diurnal cycle work is conducted. This includes at night, where stable conditions could potentially lead to higher concentrations. *See* Response 5.2 for additional discussion of modeling assumptions made for short-term NAAQS and increment analyses.

Comment 5.7
Improper Averaging of Modeled Concentrations & Likely PSD Increment Exceedance
The 24-hour standards and allowed increments at the [Brigantine Wildlife Area] for fine particulates (PM 2.5) is based on the 98th percentile number for a year averaged over three years.

The permit application under review, EPA permit Number: OCS-EPA-R2 NJ 02, has apparently been recently revised to address only one year of air quality modeling of the construction of a "project 1" of 141 turbines, a segmented part of the full 200 turbine Atlantic Shores South Project. But the application still shows in Table I-1 a three-year time frame, from 2026 to 2028, for wind turbine foundation and wind turbine generator (WTG) installation. We assume from those apparent contradictions that no air quality modeling of either construction activity or operations and maintenance activity that would logically follow the construction period was done for 2027 or 2028.

Since the allowed 24-hour concentration increments at the BWA are based on a 3-year average of the 98th percentile number for each year, this improperly segments the project to artificially show a low 3-year average concentration at the Wilderness Area based on just one year of construction activity. On the basis of this improper segmentation alone, this permit should be rejected.

The 3-year average for the fine particulate (PM 2.5) 24 hour-increment at the Wilderness Area is shown in Table 5-10 as 0.69 ug/m3. Since that is the result of averaging the first year concentration with two years of essentially no emissions, the actual first year concentration must have been three times that or 2.1 µg /m3.

We showed above in the Executive Summary and Section 2 above that with realistic assumptions just foundation installation of the full 200 project will extend into the third year. With WTG installation construction activity and associated emissions will encompass the entire three years of the averaging period.

Assuming then that the 24-hour yearly foundation installation concentrations are comparable, the 2.1 µg/m3 concentration at the BWA will occur each year and become the proper 3-year average. The emissions from the project's construction will therefore exceed the allowed increment of 2 ug/m3 for the Brigantine Class I area. Therefore, even with the current underestimated yearly modeling as described below, the permit must be denied.

Response 5.7
It should be noted that the construction activities are expected to be completed in two years. While Table 1-1 of the permit application indicates that foundation installation will start in "Q1-2026" for Project 1, EPA sought supplemental information from Atlantic Shores in response to this comment, and the applicant confirmed the time of year restrictions on pile driving and that pile driving would not be expected to start before May of the given year. Atlantic Shores also stated that the schedule in the application was originally developed to cover both pile-driven and other types of foundations, such as gravity base or suction bucket foundations, which are no longer anticipated to be used. Thus, although the application indicates construction would last from 2026 to 2028, construction would commence no earlier than May of 2026, and is expected to conclude by two years later, during the second quarter of 2028. *See* Response 5.6.

For short-term standards, such as the 24-hour $PM_{2.5}$ increment discussed by this commenter, construction emissions from all sources and for all activities were modeled continuously (24 hours per day and 365 days per year, for 8760 hours per year or 8784 hours per year in a leap year) using meteorological data for the 3-year period between 2018-2020. *See* Response 5.2 for additional discussion of modeling assumptions made for short-term NAAQS and increment analyses.

Of the short-term standards, only the 1-hour NO_2 NAAQS standard used a slightly different methodology. Instead of modeling impacts as if construction emissions occurred continuously for the entire three-year modeled timeframe, the modeling for the 1-hour NO_2 NAAQS standard modeled the worst-case emissions for two years of construction (the expected length of construction indicated in the application), and one year of emissions for the O&M phase. For each modeled receptor, the day during each modeled year with concentrations of NO_2 in the 98th percentile is identified, and the 98th percentile value for each of these three years (2 years of construction and 1 year of O&M) are then averaged together, and this average cannot exceed the 1-hour NO_2 NAAQS.

The commenter is incorrect regarding the methodology used to calculate compliance with the 24-hour Class I $PM_{2.5}$ increment. Compliance with the 24-hour Class I $PM_{2.5}$ increment is assessed at the Brigantine National Wilderness Area and is assessed on a yearly basis, not averaged over a 3-year period. As explained further in Response 5.5, the modeled concentrations of $PM_{2.5}$ at each receptor for each year are reviewed to ensure that the 24-hour $PM_{2.5}$ increment for a Class I area is not exceeded at a given receptor more than once per year (the "2nd-high"). This "2nd-high" value is examined for all three years modeled to ensure that the highest "2nd-high" value over the 3-year period (also referred to as the "high-2nd-high") does not exceed increment requirements.

Below are the 2nd-high values for each year that was used to determine the 24-hour Class I $PM_{2.5}$ increment for construction. These values can be found in the AERMOD files in the docket:

2018: 0.66406 µg/m3 on 10/09/2018
2019: 0.42058 µg/m3 on 04/06/2019
2020: 0.45476 µg/m3 on 06/19/2020

As show above in bold, the highest 24-hour impact for $PM_{2.5}$ over the three-year period was 0.66406 µg/m3 in 2018. A value representing secondary impacts (0.024 µg/m3) was then added to this value,[3] for a sum of 0.69 µg/m3; this is the value in Table 5-10 of the Air Quality Dispersion Modeling Report on page 272 of the permit application that EPA then used to determine compliance with the 24-hour Class I $PM_{2.5}$ increment. There was no averaging between the three years, and no averaging with values of 0.00 µg/m3.

For the 24-hour $PM_{2.5}$ NAAQS, where impacts are averaged over a 3-year period, there was no averaging of construction emissions across years of lower emissions, and no averaging with values of 0.00 µg/m3. *See* Response 5.5 for further discussion of calculating compliance with short-term NAAQS.

[3] Secondary impacts account for the formation of $PM_{2.5}$ in the atmosphere as a result of chemical reactions of precursor emissions, in this case SO_2 and NO_X.

Comment 5.8
Underestimated Daily Construction Emissions

The air permit application does not state the hours necessary to pile drive one foundation, but in its email of March 29, 2023 Atlantic Shores stated that it expects a single wind turbine generator (WTG) foundation pile driving installation activity to require only a limited number of hours, likely 3 to 6 hours of piling followed by several hours of less intensive transition piece installation and finishing works. It stated that the entire activity is estimated to require fewer than 12 hours of activity per day in a single location before moving to another WTG location.

The 3 to 6 hours for pile driving is unrealistically low and not consistent with the assumptions for the BOEM Biological Assessment and the NMFS Biological Opinion. Those pile driving times are based on the August 10th Jasco Applied Sciences Noise Exposure Modeling report, Appendix B, Table 1, which assumes that 15,387 strikes are needed to pile drive a 15-meter diameter foundation, which at 2 seconds per strike requires 8.6 hours to pile drive one foundation-assuming no down time.

Three hour pile driving times have only been associated with smaller 7.5 meter diameter foundations according to the BOEM in its supplemental information for the Vineyard Wind 1 project Biological Assessment of May 11th 2020. The 3 to 6 hours is also inconsistent with statements made in the air permit application itself on page 1-11 that is anticipated that it will take a maximum of 7 to 9 hours to drive one monopile.

If a time frame for pile driving of 3 to 6 hours has been used in the air quality modeling then that could grossly underestimate the daily concentrations received at the Wilderness area. The pile driving time needs to be disclosed, corrected upward as necessary, and the modeling redone.

The air permit application should have disclosed what size monopile is being installed and how long it will take to embed it in the seabed. It is important to pin down the pile driving hours required because emissions are high during that activity and air pollutant densities at the Wilderness area could increase for longer pile driving periods, depending on atmospheric conditions, including the degree of fumigation at the shore.

In comments on the air quality model of July 20, 2022, EPA staff raised concerns about the fumigation conditions at the BWA and elsewhere that affects the modeled concentration result. An analysis of the fumigation problem was also requested by EPA staff in a memorandum dated July 7, 2022 to the Modeling Clearing House within the Office of Air Quality Planning and Standards.

It was stated that this would be addressed in the application, and there is some discussion of the fumigation problem in appendix D referring to results shown in Table 2 and modeling files supporting the analysis being sent to EPA Region II. But there is no conclusion stated as to whether that has satisfied EPA concerns.

In its comments to Epsilon Associates of September 30, 2022 the EPA asked that clarification be provided as to whether emission rates used for the short-term NAAQS and PSD increment modeling represented maximum hourly emissions, this has not been clarified in the air permit application or the EPA fact sheet, but it must be.

For these hours of construction pile driving activity, the application should have described how maximum hourly emission rates are derived. Again, this is crucial to determining an accurate 98th percentile number for the year. The application should have explained which sources and engines are involved in the pile driving operation, which operate concurrently to create the maximum hourly emissions, and whether there are any overlapping vessel activities and emissions.

In internal EPA comments, a statistical analysis was requested to show these concurrently operating emission sources, but this does not appear in the permit application or the fact sheet.

Response 5.8
For the construction modeling done to show compliance with short-term (1-hour, 8-hour, and 24-hour) NAAQS and increment, sources associated with the pile driving, including both the pile driving itself and other work associated with the installation of WTG and OSS foundations, were modeled continuously (24 hours per day and 365 days per year, for 8760 hours per year or 8784 hours per year in a leap year) using meteorological data for the 3-year period between 2018-2020. *See* Responses 5.5, 5.6, and 5.7 for additional discussion. This was meant to protect NAAQS and increment regardless of what time of day pile driving occurs, how long it occurs, and whether the atmospheric conditions are conducive to higher impacts at the Brigantine National Wilderness Area. In determining compliance with short-term NAAQS and increment, there was no averaging of emission rates across non-operating hours.

For the construction modeling done to show compliance with annual NAAQS and increment, while the emissions were modeled continuously (24 hours per day and 365 days per year, for 8760 hours per year or 8784 hours per year in a leap year), the emission rate used was annualized. This means the emission rate that was modeled as occurring continuously was determined by multiplying the maximum expected emission rate by the maximum potential hours of operation of the vessel, engine, or construction activity, and then dividing by the total number of hours in the year. Spreadsheets with the “Total Hours”, “Peak Year Hours (hr/yr)”, and peak hour annual emission rates are provided in Appendix B (“Model Inputs”) of the Air Quality Dispersion Modeling Report included on pages 297-304 of the permit application.

For example, for the hydraulic hammer engine and 20 air compressors that would be used during pile driving for the foundation installation, Atlantic Shores identified peak year hours of operation for each of these pieces of equipment of 1,646 hours/yr. Assuming that there will be 141 turbines constructed in the peak year, this means the modeling accounts for 11.67 hours of pile driving for each foundation (1,646 ÷ 141 = 11.67), not 3-6 hours. Again, this assumption was only made for modeling the annual standards, not for the short-term standards (1-hour, 8-hour, and/or 24-hour).

Pile driving is present in the modeling for two construction activities: foundation installation and OSS installation. The sources and engines used in the modeling for these activities include: the heavy lift vessel (main engines 1 & 2, auxiliary engine), the bubble curtain support engine, the barge auxiliary engine, the tug engine, the crew transfer vessel engine, 20 air compressors, and the hydraulic hammer engine. *See* Response 5.12 for a list of sources modeled for foundation installation and OSS installation. These vessels and engines were included in the modeling analysis because they are the worst-case equipment Atlantic Shores expects to use for their foundation installation and OSS installation activities.

A complete list of modeled sources, including AERMOD source IDs, stack parameters, and emission rates, used in the modeling for the foundation installation are provided in Appendix B ("Model Inputs") of the Air Quality Dispersion Modeling Report, on page 305 of 460 of the permit application. A complete list of modeled sources, including AERMOD source IDs, stack parameters, and emission rates, in the modeling for the OSS installation are provided in Appendix B ("Model Inputs") of the Air Quality Dispersion Modeling Report, on page 306 of 460 of the permit application.

Regarding shoreline fumigation, and the potential impacts of construction activities at Brigantine National Wilderness Area, this was addressed in the permit application, in Appendix D ("Analysis Of Shoreline Fumigation Submitted Oct 2022") of the Air Quality Dispersion Modeling Report on pages 371-374 and demonstrated to not be a concern. Shoreline fumigation can occur on sunny days when there is a source located right along the coastline. Land warms faster than the ocean, which will result in a mixed layer in the atmosphere inland. A mixed layer is characterized by turbulence, which tends to uniformly mix the atmosphere in the vertical direction. By contrast, the airmass over water is generally cooler and more stable. When shoreline fumigation occurs, this means that during a sea breeze, the plume emitted from a source along the coastline enters the turbulent mixed layer that is located inland, and mix the pollutants towards the ground. However, the Atlantic Shores project at its closest point is located approximately 7.6 nautical miles (8.7 statute miles) from the Brigantine National Wilderness Area, and given this distance from shore, among other factors, thus the "Analysis Of Shoreline Fumigation" in Appendix D demonstrated that shoreline fumigation was not a concern for this project. Given the distance of the lease area to the Brigantine National Wilderness Area, this result was expected.

Regarding short-term emissions, and whether the modeled emission rates represented maximum hourly emissions, this was addressed in the Atlantic Shores responses on September 11, 2023 (document named "3.4.2 Atlantic Shores Responses 9-11-2023" in the docket). On page 7 of 28, EPA asked that Atlantic Shores "confirm that the modeled emission rates are the maximum hourly emission rates since these will become permit limits." Atlantic Shores provided the following response:

> *The modeled emission rates are as-described in the application, notably Section 2.1 and Section 2.1.1. The modeled emission rates are the projected emissions based on the maximum rated capacity of the equipment and maximum throughput of the facility, calculated based on detailed plans for each activity, load factors, and emission factors.*

Short-term emission rates, in grams/second, that were used in the modeling were derived using the formula below:

Short-term Rate (grams/second) = Number of Engines * Engine Rating (kW) * load factor * emission factor (grams/kW-hour) * (1 hour/3600 seconds)

Comment 5.9
Improper Averaging of Daily Emissions.

The air quality modeling should have been performed for more realistic hours per day to drive one foundation. Air pollutant densities at the wilderness area could accumulate and increase under stable atmospheric conditions for longer pile driving emission periods.

The modeling should be based on maximum daily emissions only during periods of construction, not averaged with periods of no activity. If the Atlantic Shores modeling has averaged 4-6 hours of pile driving emissions with 18 to 20 hours of no or little emission activity then it has significantly underestimated maximum hourly emission rates and the received air concentrations at the Wilderness area. This needs to be clarified in a revised All these in the water. application.

Response 5.9
The relevant modeling has not assumed 4-6 hours of pile driving per day. For an in-depth discussion on hours per day of pile driving in the modeling and impacts at the Brigantine National Wilderness Area, *see* Response 5.8.

Comment 5.10
Failure to Consider Nighttime pile driving

The extended foundation installation times presented in the Executive Summary and Section 2 point to the potential need to continue pile driving at night to maintain the annual schedules in the Biological Opinion and the proposed MMPA rule making. The air permit application assumes no pile driving at night but the NMFS Biological Opinion allows that. Atmospheric conditions at night are potentially more conducive to higher received air pollutant concentrations onshore particularly in the summer months when the pile driving is concentrated as discussed above. Anticipated nighttime pile driving therefore needs to be addressed as it may determine the higher 98th percentile concentrations at the shore for a given year.

Response 5.10
See Response 5.6. For assumptions made for pile driving in the modeling done to show compliance with annual NAAQS and increment, *see* Response 5.8.

Comment 5.11
Monthly Installation schedules

The permit application is apparently based on a uniform monthly number of foundations driven over a 10-month period, which based on the 141 turbines would be 14 per month. The BOEM EIS and Biological Assessment and the NMFS Biological Opinion are based on monthly schedules of 18 foundations in June, 23 in July,19 in August and 16 in September. These are higher than the 14 per month assumed in the permit application and it is expected that these summer months would have more air temperature inversions and lower wind speeds conducive to higher pollutant concentrations at the shore. Therefore, the uniform monthly foundation rate assumption is not as stated in the application a conservative one.

Response 5.11
As discussed in Response 5.4, if a foundation installation takes 1.5 days, then an average of 20

foundations can be installed in a month. And as previously stated, modeling for short-term NAAQS and increment (i.e., 1-hour, 8-hour, and/or 24-hour standards) did not assume that 141 turbines would be constructed in a year. Rather, construction emissions from all sources and for all activities were modeled continuously (24 hours per day and 365 days per year) using meteorological data over a 3-year period between 2018-2020. This was meant to model impacts for all meteorological conditions, including temperatures inversions and lower wind speeds, to ensure meteorological conditions most conducive to the highest concentrations were captured. *See* Response 5.4 for further explanation.

The assumption that 141 turbines will be constructed in the worst-case year was only made in modeling to show compliance with annual NAAQS and increment. When modeling for annual standards, since impacts are based on the yearly average, day-to-day and month-to-month variations are smoothed out over the course of the year.

Comment 5.12
Unclear Emission sources. Construction Emissions.

The statement in Section 4.2.1 of the application regarding source configuration for short term air dispersion modeling during construction that the modeling is "centered" on the offshore substation (OSS) install activity, around this activity are six other activities that could potentially occur in the vicinity of the OSS install activity is concerning and needs clarification. Does this mean that only foundation installation and WTG installations close to an OSS installation have been included in the yearly modeling? Does it mean that 141 installations have been modeled, but only at the OSS installation location and not at their real locations?

The application should have modeled the installation of all the 141 foundations and WTGs at their real locations in the so-called peak year of modeling (see Section 10).

The source configuration discussion in Section 4.2.1 for short term air dispersion modeling during construction provides only a general discussion of activities during construction, it does not list or reference the specific emission sources that are included in the modeling. It says nothing about vessel support emissions which raises concern that the source configuration is not inclusive.

The permit application should be *specific* as to what the short-term construction activity is and what vessels are being included in the short-term calculations for each year *for pile driving, other foundation installation activities, WTG and offshore substation construction.*

For example, for foundation installation, it should specify whether or not emissions from bulk carriers, medium heavy lift vessels, jack up vessels, towing tugboats, transport barges, and service operation vessels are being included in the calculations. For offshore substation installation, it should specify whether large heavy lift vessels, medium heavy lift vessels, bubble curtain support vessels, towing tugboats, assistance tugboats and transport barges are included in the emission sources and air dispersion modeling calculations. It should also disclose whether any operations and maintenance, or vessel survey emissions occur concurrently with construction.

This is especially needed because on page 117 of the application Atlantic Shores raises a number of issues with respect to what should or should not be included, and it is unclear what the modeling has or has not included.

The EPA has provided some emission source information in its fact sheet but it is not approving its own fact sheet, it is approving a company's application. This information must be provided in the application so it is clear that the emissions that EPA is requiring for the air quality modeling are being included in that, as opposed to what Atlantic Shores is asking for. The general statement by Atlantic Shores that it has done the air quality modeling based on *its* interpretation of the EPA rules is unsatisfactory. This must be clarified and the modeling done based on EPA's interpretations of the rules, not Atlantic Shore's.

Response 5.12
Figure 4-4 of the Air Quality Dispersion Modeling Report, on page 242 of 460 of the permit application displays the sources that were included in the *annual* modeling of construction emissions. The following sources were included: 141 wind turbine locations, 4 OSS positions, and 3 line volume sources representing transit emission from vessels. The wind turbine locations and OSS positions were in the expected locations of this equipment, not clustered in a single location, and the 3 line volume sources modeled emissions occurring along vessel travel routes. For each of the expected 141 turbine positions, the emissions from the following activities were included: foundation installation, foundation scour protection, inter array cable installation, inter array cable pre-lay, inter array cable scour protection, WTG installation, WTG commissioning, and fuel bunkering. For the 4 OSS positions, the following activities were included: OSS installation and the OSS commissioning. The transit emissions are for vessels traveling to and from the following ports: Atlantic City, New Jersey Wind Port, and Europe. Spreadsheets detailing all the sources used in the modeling for annual standards, including AERMOD source IDs, stack parameters, and emission rates are provided in Appendix B ("Model Inputs") of the Air Quality Dispersion Modeling Report, from pages 296-304 of 460 of the permit application.

For the short-term construction modeling, spreadsheets detailing the sources used and modeled emission rates are provided in Appendix B ("Model Inputs") of the Air Quality Dispersion Modeling Report, from pages 305-311 of 460 of the permit application. The spreadsheets list what sources were modeled for each of the activities, including: foundation installation, OSS installation, foundation scour protection, inter array cable installation, inter array cable pre-lay, inter array cable scour protection, and WTG installation. The spreadsheets also include auxiliary engines and support vessels, such as the Bubble Curtain Support vessel. Below are 8 tables summarizing the vessels/engines for each activity in the short-term construction modeling:

Foundation Installation	
Vessel	**Engine**
Heavy Lift Vessel	Main Engines 1
Heavy Lift Vessel	Main Engines 2
Heavy Lift Vessel	Auxiliary Engine
Bubble Curtain Support	Engines
Barge	Auxiliary Engine
Tug	Engines
Crew Transfer Vessel	Engines

Air Compressors (1-20)	20 Air Compressors
Hydraulic Hammer Engine	Hammer Engine

OSS Installation	
Vessel	**Engine**
Heavy Lift Vessel	Main Engines 1
Heavy Lift Vessel	Main Engines 2
Heavy Lift Vessel	Auxiliary Engine
Bubble Curtain Support	Engines
Barge	Auxiliary Engine
Tug	Engines
Crew Transfer Vessel	Engines
Air Compressors (1-20)	20 Air Compressors
Hydraulic Hammer Engine	Hammer Engine

Scour Protection	
Vessel	**Engine**
Fall Pipe Vessel	Engines
US Dredger	Main Engine 1
US Dredger	Main Engine 2
US Dredger	Auxiliary Engine

Inter-array Cable Installation	
Vessel	**Engine**
Cable Installation Support	Engines
Cable Installation Vessel	Main Engines
Cable Installation Vessel	Auxiliary Engines

Pre-Lay Activities for the Inter-Array Cable	
Vessel	**Engine**
Sand Wave Clearance	Main Engine
Sand Wave Clearance	Auxiliary Engine
Pre-Lay Grapnel Run AHTS 1	Main Engine
Pre-Lay Grapnel Run AHTS 1	Auxiliary Engine
Pre-Lay Grapnel Run AHTS 2	Main Engine
Pre-Lay Grapnel Run AHTS 2	Auxiliary Engine

Inter-array Cable Scour Protection	
Vessel	**Engine**
Fall Pipe Vessel	Engines

WTG Installation	
Vessel	**Engine**
Jackup Installation Vessel	Main Engines 1-1
Jackup Installation Vessel	Main Engines 1-2

Jackup Installation Vessel	Main Engines 1-3
Jackup Installation Vessel	Main Engines 1-4
Jackup Installation Vessel	Main Engines 2-1
Jackup Installation Vessel	Main Engines 2-2
Jackup Installation Vessel	Main Engines 2-3
Jackup Installation Vessel	Auxiliary Engine
Jackup Feeder	Main Engine
Jackup Feeder	Main Engine
Jackup Feeder	Auxiliary Engine
Crew Transfer Vessel	Engines

Transit	
Vessel	**Engine**
Atlantic City Transits	Engine
New Jersey Wind Port (NJWP) Transits	Engine

The vessels and engines in the tables above were included in the modeling analysis because they are the worst-case equipment Atlantic Shores expects to use for their construction activities. For an in-depth discussion of the sources used in pile driving in the modeling for the foundation installation and OSS installation, *see* Response 5.8. O&M was not modeled as occurring at the same time as construction. Vessel survey emissions were included in the annual O&M modeling.

The final modeling submitted meets all of EPA's requirements, and neither the emissions in the C&C phase nor in the O&M phase will cause or contribute to any violations of any relevant NAAQS or PSD Increment.

Comment 5.13
Operations & Maintenance Emissions.

The air permit application does not explain what operation and maintenance activities are being modeled. It would appear that the modeled concentrations are low, considering the high risk of turbine component failure and the level of maintenance and repair expected for these large wind turbines. Prior studies of smaller turbines have indicated a high probability for major maintenance and repairs for a single turbine in one year, and here we have 200 turbines. In addition, the stresses on the larger turbines are greater than that for the smaller ones, pointing towards an even higher frequency of component failure occurrences. Therefore, the permit needs to explain what the frequency and risk of component failure is, how it would be addressed, and what emissions would be incurred during these periods.

Response 5.13
In response to this comment, EPA has sought additional information from Atlantic Shores, to supplement the information in its application, explaining and supporting the operations and maintenance assumption used for its air quality modeling. Atlantic Shores has explained that, to meet a series of design requirements for wind turbines known as IEC 61400, wind turbines including blades are designed and certified to 30 years lifetimes. The design considers normal and extreme conditions that are expected on the site as per applicable standards (including but

not limited to icing, rain, hurricanes, and lightning). BOEM's ROD requires that the design and manufacturing of the WTG components be certified to the requirements of IECRE OD-502, 2018 and verified per BOEM requirements.

In the application and in more recently-submitted supplemental information, Atlantic Shores explains that scheduled maintenance of WTGs includes regularly scheduled inspections and routine maintenance of mechanical and electrical components. The types and frequency of inspections and maintenance activities are based on detailed original equipment manufacturer (OEM) specifications. Annual maintenance campaigns are dedicated to general upkeep (e.g., bolt tensioning, crack and coating inspection, safety equipment inspection, cleaning, high-voltage component service, and blade inspection) and replacement of consumable components (e.g., lubrication, oil changes).

Atlantic Shores' supplemental information also explained that preventative maintenance (e.g., planned replacement of components such as motors and brakes) occurs less frequently (every 5 to 10 years) but is also regularly scheduled. Unscheduled inspections and minor repairs, such as replacement of small components, can be performed via the regular maintenance vessels. Replacement of large components (e.g., blades, generators, gearboxes, and large bearings) or structural repair may require support vessels, such as jack-up vessels with cranes, as well as larger teams of technicians.

The Air Quality Dispersion Modeling Report on pages 243-246 of 460 of the permit application includes a discussion and figures depicting the sources represented in the modeling of the Operations & Maintenance (O&M) phase. For the *short-term* NAAQS and increment modeling, two scenarios are included: (1) routine daily operations & maintenance activities and (2) simultaneous heavy repair. In addition, transit emissions for vessels traveling to and from the wind farm were also represented in the short-term O&M modeling.

To be conservative, O&M emissions were modeled as if they occurred continuously (24 hours per day and 365 days per year, for 8760 hours per year or 8784 hours per year in a leap year) using meteorological data for the 3-year period between 2018-2020. The only source in the short-term O&M modeling that used a slightly different methodology was the service operation vessel (SOV). The SOV will only operate 12 hours day, and otherwise be parked away from any structures, while minimizing fuel use, for the other 12-hour period. While operating, the SOV may operate at up to four turbine locations in a day. To represent this, the SOV emissions for the "work" half of one day were divided among these four turbine locations (which simulates the SOV servicing the 4 turbines), and the emissions for the "parked" half of the day were located at a fifth position located between the four turbines. This means that the overall emission rate was conserved, but at a given time, portions of the emissions are being modeled in five different locations simultaneously. This approach is depicted by Figure 4-5A in the Air Quality Dispersion Modeling Report, on page 244 of 460 of the permit application.

For the short-term modeling of the routine daily O&M activities, the sources represented in the modeling include: the SOV (main and auxiliary engines), daughter craft vessel engine, and 2 crew transfer vessel engines. These vessels and engines were included in the modeling analysis because this is the equipment Atlantic Shores expects to use for its routine O&M activities. A complete list of modeled sources used in the modeling of routine daily O&M, including AERMOD source IDs, stack parameters, and emission rates, is provided in Appendix B ("Model Inputs") of the Air Quality Dispersion Modeling Report, on page 318 of 460 of the permit application.

For the short-term modeling of the heavy repair activities, the sources represented in the modeling include: US Feeder Vessel (2 main & 2 auxiliary engines), European Jack-up vessel (5 main engines & 1 auxiliary engine), inter array cable repair vessel (main & auxiliary engines). These vessels and engines were included in the modeling analysis because this is the equipment Atlantic Shores expects to use for the highest-emitting type of heavy repair activity. A list of modeled sources used in the modeling for the heavy repairs activities, including AERMOD source IDs, stack parameters, and emission rates, are provided in Appendix B ("Model Inputs") of the Air Quality Dispersion Modeling Report, on pages 319 & 320 of 460 of the permit application.

O&M modeling for *annual* NAAQS and increment included modeling of visits to 200 WTG positions and 4 OSS positions over the course of a year. The sources represented in the modeling were the same as those used in O&M modeling for short-term NAAQS and increment. The modeling then used emission rates based on the expected yearly hours of operation for each of the O&M activities occurring at each WTG or OSS location. As some O&M occurs along the export cable, emissions from the export cable repair vessel and export cable survey vessel were included as well. For vessels represented in the annual O&M modeling, transit emissions from vessels traveling to and from the wind farm were also included.

Comment 5.14
Modeling Distances

It is not stated in the application and therefore unclear what distances from source to receptor are being used in the air quality PSD modeling. The discussion in Appendix C on the plume blight visibility analysis uses (Table 1) the centroid of the wind complex as the source location or 18 miles to the Wilderness Area receptor. The locations of the 24-hour construction emission sources in Figure B.3 of the application also places the foundation and WTG installs close to the center of the project complex, as opposed to the western boundary, which is considerably closer to the [Brigantine Wilderness Area].

There is a very significant difference between the distance from the centroid versus the distance from the closest turbine to shore, which is only 9.4 miles. Use of the centroid will significantly underestimate the 98th percentile value for a given year because it will not address the higher concentrations that are expected from the foundation and WTG installs on the western side of the complex.

The yearly modeling should have included the foundation and WTG installs at each of their actual locations to determine an accurate data set of daily received concentrations at the Wilderness area from which the 98th percentile can be obtained.

Response 5.14
For the short-term NAAQS and increment modeling (1-hour, 8-hour, and/or 24-hour standards) for the C&C phase, the distance from the sources to the nearest (offshore) receptors were 500

meters. This is because, as authorized by the Coast Guard, there will be a 500-meter safety exclusion zone surrounding construction activities, which precludes the general public from being within 500 meters of the construction activities and thus supports excluding this area from ambient air. As previously mentioned in Response 5.2, for the short-term construction modeling, the emission sources were placed in the northwest corner of the lease area, closest to the coastline of New Jersey and the Brigantine National Wilderness Area, where they were modeled continuously for 3 years. This was meant to ensure the highest impacts were modeled at the Brigantine National Wilderness Area and the 1-hour, 8-hour, and 24-hour NAAQS and increment were protected. No assumption using the centroid of the wind farm was used for the short-term construction modeling for NAAQS and increment.

For short-term NAAQS and increment modeling for the O&M phase, the distance from the sources to the nearest (offshore) receptor is 25 meters, with the exception that it will use a 500-meter safety exclusion zone for heavy repair activities. Once again, emission sources were placed in the northwest corner of the lease area, closest to the coastline of New Jersey and the Brigantine National Wilderness Area, where they were modeled continuously for 3 years. This was again meant to ensure the highest impacts were modeled and the 1-hour, 8-hour, and 24-hour NAAQS and increment were protected. And again, no assumption using the centroid of the wind farm was used for the short-term O&M modeling for NAAQS and increment.

For both the C&C and O&M phases, the modeling to show compliance with *annual* NAAQS and increment did not use a safety exclusion zone. Receptors were placed throughout the wind farm, as well as in the ocean between the project and shore, and onshore. The annual modeling for the C&C phase modeled emissions from the 141 turbine positions that are closest to the shore and from the positions for four large OSSs[4], to represent a worst-case year of construction. The annual modeling for the O&M phase modeled emissions from all 200 turbine positions and from positions for four large OSSs, since it is expected that all 200 turbine positions and the OSSs will be visited over the course of each year.

Comment 5.15
Non-Representative Meteorological Conditions.

The application is using three years of meteorological data taken at the Atlantic City International airport. Such data is not representative of the atmospheric conditions offshore over which the pollutants are transported. Similar data was used by Atlantic Shores in its construction and operation plan (COP) to describe the frequency at which wind turbines would be visible and was found to be very inaccurate. It was in fact dismissed by Rutgers University staff who had sponsored the original study, and who agreed that it was not representative of offshore wind visibility conditions.

It is not clear why the meteorological observations from the Integrated Surface Database discussed in Appendix E, that were used for the visibility blight analysis, were also not used for the air quality modeling. That database appears to have more offshore condition representation.

[4] Atlantic Shores has indicated it will use 4 large, 5 medium, or 8 small offshore substations. Atlantic Shores has indicated it would not construct more than 4 OSSs in one year. Construction of large OSSs would logically result in higher emissions than construction of 4 medium or small OSSs.

This issue should have been addressed in the permit application.

Response 5.15
The meteorology data in the modeling did not use the Atlantic City International airport. The meteorological data used within AERMOD (the model used for this project) was provided by EPA from the Weather Research and Forecasting ("WRF") model and extracted by EPA using the Mesoscale Model Interface ("MMIF") for the 2018-2020 time period to create overwater meteorological files for input into AERMOD. The data extraction point for the meteorological dataset was 74.126° W, 39.248° N, which is overwater and located within the Atlantic Shores wind farm. The data was then processed by AERCOARE to generate the surface and profile meteorological data necessary for input into AERMOD. This alternative model approach was approved by EPA's Model Clearinghouse for the Atlantic Shores project on July 28, 2022. This approach has also been approved on over a dozen occasions for modeling the NAAQS and increment compliance for offshore wind projects. *See also* Response 5.19.

The modeling for the Air Quality Related Values (AQRVs) used the same meteorological data as the air quality modeling analyses conducted to demonstrate compliance with the NAAQS and PSD increment standards. The meteorological data used for the modeling for the AQRVs is discussed in Appendix C ("Class I Air Quality Related Values Analysis") on pages 353-354 of the Air Quality Dispersion Modeling Report. On page 353, under Section 2.2, Meteorological Data and Modeling Domain, the report states:

> *The three years (2018-2020) of meteorological data were produced by EPA using the Weather Research and Forecast Model (WRF).*

The Integrated Surface Database discussed in Appendix E is a global database that consists of surface meteorological observations. The Integrated Surface Database was used, not for the AQRV modeling, but as part of an evaluation of how well the WRF model was performing when used for this project. The reason why the WRF data was used is because its data extraction point was overwater and located within the Atlantic Shores wind farm. By contrast, the data in the Integrated Surface Database mentioned by the commenter consists of meteorological data from onshore meteorological stations and from unrepresentative buoys located at a considerable distance from actual project site.

The WRF model data that was extracted using MMIF was preprocessed with AERCOARE. AERCOARE uses the Coupled Ocean Atmosphere Response Experiment ("COARE") air-sea flux code to read hourly prognostic meteorological data and addresses conditions in the marine environment. Essentially, AERCOARE was utilized to ensure the meteorological data is appropriate for overwater applications within AERMOD.

Comment 5.16
Foundation Size

The permit application does not specify the foundation size. The BOEM final EIS and Biological Assessment under the Endangered Species Act are based on foundations of 15 meters in diameter which are quite large and have not been installed previously, potentially involving longer pile driving and foundation installation times.

Response 5.16
In response to this comment, EPA sought supplemental information from Atlantic Shores. As described in COP Volume I, Table 1.1-1 as well as in the OCS Air Permit Application, Atlantic Shores has selected a Project Design Envelope (PDE) that includes monopiles up to 15 m in diameter for the WTG foundations and jackets with pin piles up to 5 m in diameter for the OSS foundations. A complete list of dimensions for both foundations can be found in Volume I of the COP in Table 4.2-1 and 4.4-2. The analysis included in the OCS Air Permit application covers the full PDE of foundation sizes.

As previously stated, for C&C phase modeling to show compliance with short-term NAAQS and increment, sources associated with pile driving were modeled as if operating continuously (24 hours per day and 365 days per year, for 8760 hours per year or 8784 hours per year in a leap year) using meteorological data for the 3-year period between 2018-2020. *See* Response 5.2 and Response 5.8.

For a discussion on the hours of pile driving assumed in modeling to show compliance with the annual NAAQS and increment, *see* Response 5.8.

Comment 5.17
The Annual Average $PM_{2.5}$ concentration.

The air permit application does not explain how the annual $PM_{2.5}$ calculation was done and what was averaged over a year. The application modeling results show a 24-hour $PM_{2.5}$ level at the Wilderness Area of 0.69 µg/m3 and an annual average of 0.003 µg/m^3. If the modeling portrayed 141 turbines being installed in one year and that involved many days then it is unclear why the annual average would be orders of magnitude lower than the daily number. This should be explained. If it is due to the use of very short time periods for pile driving averaged with long periods of little activity, then the annual calculation would be underestimated for reasons similar to what was discussed in Section 5 above.

Response 5.17
To show compliance with annual $PM_{2.5}$ NAAQS and increment (both Class I and Class II), modeling is used to calculate the highest yearly mean concentration recorded at each receptor. To do this, hourly $PM_{2.5}$ concentration values at each receptor are summed up and divided by 8760 hours per year, which provides the yearly mean. This process is repeated for 2018, 2019, and 2020 for each receptor. Then, the yearly means for each of the three years are compared, and the highest value is selected as the annual increment value. The estimated annual hours of operation of each modeled activity reflected conservative estimates that a high number of turbines would be installed in a given year; it is likely actual construction will not install this number annually.

The reason there is such a large variation between the annual Class I $PM_{2.5}$ increment and the 24-hour Class I $PM_{2.5}$ increment is related to the meteorology. An annual mean will feature a wide range of meteorological conditions over the course of the year, including variations in wind direction and speed. The highest hourly concentrations will typically be located downwind of the wind farm, but the receptors that are downwind will vary with the direction of the wind. Figure 4-13 in the Air Quality Dispersion Modeling Report, on page 259 of 460 of the permit application, is a wind rose for the overwater meteorology data used. A wind rose provides a distribution of the wind speeds and directions at a given location. During the 2018-2020 period, the most frequent wind direction is coming from the southwest (moving southwest to northeast). The Brigantine National Wilderness Area is located to the northwest of the wind farm. Thus, the highest impacts at the Brigantine National Wilderness Area will be favored when wind directions are originating from the southeast (moving southeast to northwest), which only occurs a smaller percent of the time.

The 24-hour Class I $PM_{2.5}$ increment value is naturally higher because emissions are averaged over a shorter period (24 hours vs one year). Winds and meteorological conditions originating from the southeast (moving southeast to northwest) and thus leading to the highest concentrations at the Brigantine National Wilderness Area are more likely to be sustained over the course of day, whereas they vary significantly over a year (as discussed above).

As discussed in Response 5.8, for the hydraulic hammer engine and 20 air compressors that would be involved during the pile driving for the foundation installation, annual emission rates were based off peak year hours of operation of 1,646 hours/yr. If we divide 1,646 hours of operation a year by 141 WTG foundation installations, this results in an estimate that each of 141 WTG foundation locations will require approximately 11.67 hours of pile driving. This differs from calculations to show compliance with short-term NAAQS and increment, since the annual emission rates used to show compliance with one-year standards account for how many hours during the year a given engine's emissions are expected, whereas the short-term standards calculations instead use an emission rate based on constant operation of a given engine every hour of the year.

Comment 5.18
Commenter thinks this project should be denied not only because the Atlantic Shores wind turbines reasonably have the potential to exceed EPA emission standards, but the cumulative effects of this wind farm must be taken into context with other wind farms: notably the New York Bight projects. Consequently, as a matter of protective policy, the air quality impacts of other offshore wind projects planned for the New York Bight should also be considered and added to the impacts contemplated in Atlantic Shores' draft air permit. This must also include the pre-construction surveying activities conducted during the planning and design phases of Projects 1 and 2.

Response 5.18
Commenter expressed concern regarding the cumulative effects of this project with the New York Bight projects. EPA assumes that this reference to the New York Bight projects is to a series of 6 OCS wind leases auctioned by BOEM on Feb. 23, 2022, and for which BOEM issued a Draft Programmatic Environmental Impact Statement on Jan. 8, 2024. At this time, no OCS air permit applications have been submitted to EPA by any of these six proposed New York Bight projects. Also, at this time, it is not certain how much construction overlap there will be from any of the New York Bight projects with the construction activities for Atlantic Shores. In addition, it would be difficult to quantify emissions from any vessels or engines for any of these projects

without complete air permit applications. Each application is reviewed once complete and it needs to address the air quality impacts from the construction and operation activities of other wind farms that have received OCS permits or have complete OCS air permit applications pending as of 30 days before a project submits its application, if they occur concurrently. *See* EPA, New Source Review Workshop Manual, at C.34 (October 1990). Modeling for future wind farm projects seeking an OCS air permit near Atlantic Shores will have to account for Atlantic Shores' expected emissions.[5] However, Atlantic Shores was not required to model cumulative impacts from the New York Bight projects.

It is not clear which activities the commenter is referring to as pre-construction surveying activities conducted during the planning and design phases of Projects 1 and 2. However, activities occurring prior to the construction of the permitted project are outside the scope of EPA's action on Atlantic Shores' OCS permit application under the Clean Air Act, and will not occur concurrently with the permitted project.

Regarding the commenter's concern that the project has the potential to exceed EPA emission standards, the modeling and air quality analyses conducted for this project do not indicate that the project will result in any exceedance of NAAQS or PSD increment under the terms and conditions of the OCS air permit. *See* Responses 5.1, 5.2, 5.3, 5.6, 5.8, 5.12, and 5.13 for discussion of the conservative modeling assumptions used to ensure that the project would not cause an exceedance of NAAQS or PSD increment.

Comment 5.19
Use of a New Air Quality Model.

The permit application is using a new model, the AERCORE/AERMOD approach as opposed to the traditional EPA Guideline model, the Offshore and Coastal Dispersion (OCD) model. The application presents alleged attributes of the new model, but the OCD model was also capable of dealing with offshore pollutant transport. The application presents no study confirming that the new model has been verified by measurement for accuracy for the offshore conditions here. Therefore, at a minimum there should be a demonstration that the new model is conservative with respect to the OCD model. The OCD model should be run with the same parameters as the new model and the two compared before the new model is used here. If the new model is not conservative with respect to the OCD model, then an explanation is in order as to the reasons for that.

Response 5.19
While the Offshore and Coastal Dispersion (OCD) model is currently listed as the preferred model for over-water dispersion in EPA's *Guideline on Air Quality Models* (40 C.F.R. Part 51, Appendix W), the dispersion algorithms used in the AERMOD model include the latest

---

[5] To the extent the commenter intended to express concern about impacts from other wind farms besides the New York Bight projects, the nearest project that has received an OCS air permit or has a pending complete OCS air permit application is Empire Wind, which received an OCS air permit on February 15, 2024. However, Empire Wind is at a considerable distance away, such that emissions from this project will not impact air quality in the area affected by emissions from Atlantic Shores Projects 1 and 2. Empire Wind is approximately 108 kilometers from the Brigantine National Wilderness Area.

advancements in dispersion theory and are considered state-of-the-art. Section 3.2 of the *Guideline on Air Quality Models* provides a process for an applicant to receive approval to use an alternative model, and Section 3.2.2 lays out the requirements for an applicant to demonstrate that use of an alternative model is appropriate. Furthermore, EPA has proposed the COARE algorithm used in AERCOARE be added to AERMET, the preferred meteorological data preprocessor named in Appendix W and the one that is used in AERMOD. *See* Response 5.15 for a brief description of COARE.

To justify using the AERCORE-AERMOD approach, the applicant provided the following justification on pages 2-3 of their alternative model request (document named "3.3.1 Atlantic Shores Alternative Model Approval Request" in the docket) submitted to EPA on May 31, 2022:

> *AERCOARE-AERMOD is preferred by Atlantic Shores over OCD because of the following technical advantages, options, and features available in the model:*
>
> 1. *The Plume Rise Model Enhancements (PRIME) downwash algorithm can be used to assess impacts in the cavity and wake regions of structures. While the OCD model does incorporate platform downwash, Atlantic Shores has proposed use of PRIME considering the platform as a solid structure which will result in conservative, overprediction of concentrations.*
> 2. *The Plume Volume Molar Ratio Method (PVMRM) and Ozone Limiting Method (OLM) may be used by the Project to estimate the conversion of oxides of nitrogen (NOx) to nitrogen dioxide (NO2). If PVMRM or OLM are not used, the Ambient Ratio Method (ARM2) screening technique will be used within the model[.]*
> 3. *Output can be generated in the statistical form that is needed to assess compliance with the newer statistically based National Ambient Air Quality Standards (NAAQS), such as 1-hour NO2, and PM2.5.*
> 4. *The AERMOD-AERCOARE model can model multiple line sources, and more than 5 areas sources within the same model run and does not limit the number of sources that can be modeled simultaneously.*
> 5. *The AERMOD-AERCOARE model can model volume sources[.]*
> 6. *Calm wind conditions can be processed by the AERMOD-AERCOARE model.*
> 7. *The dispersion algorithms used in the AERMOD portion of AERCOARE-AERMOD are considered state-of-art by USEPA. OCD dispersion algorithms have not been updated to account for current advancements in the understanding of the boundary layer.*
> 8. *AERCOARE-AERMOD does not artificially limit the number of receptors that can be considered in an analysis.*
> 9. *Several of the programs (MAKEUTM, MAKEGEO) used to generate inputs into the OCD model require changes to the program Fortran code to generate the correct inputs for OCD.*
> 10. *AERCOARE will directly accept Weather Research and Forecasting (WRF) data model predicted hourly meteorological output from the Mesoscale Model Interface (MMIF) program.*

As part of the alternative model request sent to EPA Region 2, the applicant provided information to demonstrate that the AERCORE-AERMOD approach is not inappropriately biased for regulatory application, as required by Section 3.2.2 of the *Guideline on Air Quality Models*.[6] *See* pages 14-16 of the "3.3.1 Atlantic Shores Alternative Model Approval Request" ("Alternative Model Request") document in the docket for this permitting action. On page 15 of its Alternative Model Request, Atlantic Shores concluded from past studies that "[t]he AERMOD predictions using AERCOARE-prepared meteorological data tend to be biased toward over-prediction for the highest concentrations, with less than a factor of 2 under-prediction at the lower concentrations. Importantly, AERCOARE-AERMOD does not appear to be biased toward underestimates for the higher end of the frequency distribution."

After reviewing the applicant's alternative model request, EPA Region 2 concluded that "… it is evident the AERCOARE/AERMOD approach does not result in systematic underprediction of concentrations. Instead, the evidence more likely leads to the conclusion the approach is conservative." *See* pages 7-8 of the document named "3.3.2 22-II-02_Region2_MCHRequest_AtlanticShores" in the docket for this permitting action. Region 2 approved the applicant's request to use the AERCOARE-AERMOD alternative model on July 20, 2022. On July 27, 2022, EPA's Model Clearinghouse concurred with Region 2's conclusion. *See* the document named "3.3.3 22-II-02_MCHResponse_Region2_AtlanticShores" in the docket for this permitting action.

Furthermore, on page 16 of the Alternative Model Request, Atlantic Shores notes that EPA Region 1 came to a similar conclusion when it approved an alternative model request for the Park City Wind offshore wind project: "Region 1 concludes it is evident the AERCOARE/AERMOD approach does not result in systematic underprediction of concentrations. Instead, the evidence more likely leads to the conclusion the approach is conservative." The use of AERCOARE/AERMOD for offshore facility modeling for PSD purposes has been approved in over a dozen instances to date.

Comment 5.20 (23,
The Atlantic Shores Project has not included a reasonable accounting of the total lifetime emissions cost to our State. Where there is an attempted analysis, the ranges of potential outcomes are far too large to justify a project of this scale. The model's assumptions are not sound. This needs to be sent back to the drawing board before a permit can be granted.

In analyses measuring the net emissions caused under this project, there is lack of reasonable accounting for the increased distances and engine run time from commercial and recreational vessels that may operate in the area. These vessels may want to avoid several routes through these turbine areas due to the increased risk of accidents. According to the National Academies, "offshore wind farms can interfere with ship radar and navigation." Several of these area avoidances will therefore result in increased lifetime emissions.

Response 5.20
In accordance with CAA requirements, the permit is supported by analysis of short-term and annual air impacts that correspond to the NAAQS and PSD increments, as well as analysis of AQRV impacts on Class I areas. *See* Responses 5.1 to 5.17 for discussions regarding the assumptions used for both annual and short-term NAAQS and PSD increment modeling.

[6] *See* 40 C.F.R. Part 51, Appendix W § 3.2.2(e)(iv).

Assumptions used in the air quality modeling analyses ensure the highest impacts under three years of meteorological conditions were modeled and the NAAQS and PSD Increment would be protected throughout the construction and operation of the permitted wind farms. The modeling included emissions from vessels associated with the project and transiting to and from the wind farms or conducting work at the wind farms; this is distinct from the transit of vessels unassociated with the project that choose to travel around the project area. The final modeling submitted meets all of EPA's rules, and air emissions in neither the C&C or O&M phase will cause or contribute to any violations of any relevant NAAQS or PSD Increment.

Note that any emissions from increased distances and engine run time from non-project vessels in the area are not expected to significantly impact air quality. While there will be temporary 500-meter safety exclusion zones near turbines, commercial and recreational vessels operating in the area will only be required to avoid these turbine locations during construction activities, which will occur within a 2-year period, or during heavy repairs during the O&M phase.

See Responses 5.1, 5.2, 5.3, 5.6, 5.8, 5.12, and 5.13 for more information regarding the worst-case assumption made in NAAQS and PSD increment modeling analyses for this project.

Comment 5.21
This comment is about the ocean breeze. I saw this week when the wind was blowing over the ocean, it was so easy to cool off our shores, and that is why people come here, but with the wind turbines, it will capture the wind, and we will not get the ocean breeze, and that will mean that we will have to use more electricity, in order to have more air conditioning.

Response 5.21
This topic is addressed for the Atlantic Shores project in a February 2022 white paper prepared for BOEM, entitled "Supporting National Environmental Policy Act Documentation for Atlantic Offshore Wind Energy Development Related to Microclimates" (*available at:* https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Microclimate%20white%20paper.pdf). The white paper explains how microclimates are formed within offshore wind facilities and finds that while microclimate effects are important for planning purposes, the effects are negligible onshore and to the overall climate. Briefly, there are effects under certain conditions, but they are small and difficult to distinguish from natural variability even with sophisticated techniques. They are not necessarily particular to being a wind turbine, as one would find similar effects for any large structure including buildings onshore. The paper concludes that although some small-scale climatic shifts could occur offshore, sea breezes (where the cooler air over the ocean is pulled shoreward as the hotter air rises above the land) would not be disrupted by the presence of wind turbines offshore.

A second study that also considered the surface impacts of large offshore wind farms is a May 25, 2022 study by Maryam Golbazi *et al.*, entitled "Surface Impacts of Large Offshore Wind Farms." 2022 Environ. Res. Lett. 17 064021, *available at* https://iopscience.iop.org/article/10.1088/1748-9326/ac6e49/pdf. The study was focused on the meteorological impacts of larger wind farms with turbines exceeding power ratings of 10 MW. The study used the Atlantic Shores site in this permit as one of the sites in its modeling. The study found wind speed reductions at the surface within the wind farm to be less than 0.5 m/s (less than a 10% reduction) and were found to be negligible near the coastline. Surface temperatures during the summer were found to cool slightly (by around 0.06 degrees Celsius) both within the wind farm and at the coastline. Overall, the study concludes that any impacts on wind speeds and temperatures would be small and nearly impossible to recognize.

Comment 5.22
According to commenter, this project should be denied because based on page 24 of the Fact Sheet, 40 C.F.R. Part 55 Air Quality Standards are exceeded, by the Atlantic Shores wind turbines in Brigantine.

Response 5.22
Page 24 of the Fact Sheet states that the Atlantic Shores project is a major facility that triggers the Prevention of Significant Deterioration (PSD) federal regulations (it exceeded, the threshold for those requirements to apply). Since the project's emissions trigger PSD for several pollutants, including NO_2, CO, PM, PM_{10}, $PM_{2.5}$, and GHG, the following PSD requirements apply to the Atlantic Shores project:

1. Perform a Best Available Control Technology (BACT) Analysis
2. Establish BACT Limits
3. Perform Air Quality Impact Analyses
4. Perform Additional Impact Analyses

The permit applicant was required to conduct a BACT analysis and the permit includes BACT limits for NO_x, CO, PM, PM_{10}, $PM_{2.5}$, and GHG emissions from the marine and non-marine engines located on vessels that will be OCS sources, and on WTGs or OSSs, as well as for GHG emissions from the SF_6-insulated electrical switchgears.

The air quality analyses demonstrated that emissions in the C&C and O&M phases will not cause or contribute to any violations of the NAAQS or PSD Increment, including at the Brigantine National Wilderness Area. Furthermore, an additional impacts analysis was conducted to assess the project's impacts on soils, vegetation, and visibility. *See also* Responses in Section 6.0.

Comment 5.23
As part of the public comment process, Atlantic Shores submitted the following comments to clarify the following specific items in the public record:

Additional Clarifications

a) The AERMOD model appropriately fulfills regulatory standards for CAA permits. Emissions used in the AERMOD modeling represent peak hour emissions. This is shown by the column labels on the model inputs in Appendix B to the Air Quality Dispersion Modeling Report, which is itself Appendix C to the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application. Peak emissions were calculated using the methodology described in Section 2.2 of the Outer Continental Shelf Air Permit Application, which reflects that the model assumes the peak hour emission rate for the whole 24-hour day for short-term modeling.

b) For all construction activities, short-term model input emission rates, in units of grams per second, were generated for the peak hour and assumed to run 24 hours per day for all short-term model runs, which is a conservative approach.

c) The different averaging times (short-term or annual) of the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) Increments are represented differently in the air dispersion modeling performed for the Atlantic Shores Projects. These are described in Section 4.2 of the Air Quality Dispersion Modeling Report, which is Appendix C of the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application.
   - The annual emissions analysis and the 24-hour analysis of $PM_{2.5}$ are independent from each other and performed differently.
   - The short-term 24-hour analysis uses the peak hour emissions from the model inputs table for each source.
   - The annual analysis includes the worst-case year's predicted hours per year of operation for each source.
   - This is demonstrated in Appendix B to the Air Quality Modeling Report (Appendix C to the Air Plan Application).
   - For comparison with the $PM_{2.5}$ annual NAAQS and PSD Increments, the project is modeled assuming continuous emissions at the 141 nearest-to-shore wind turbine generator (WTG) locations over a three-year period, which reflects an overestimation of impacts instead of truncating the project.

d) Atlantic Shores is proposing to construct up to 200 WTGs. The peak year emissions accounts for 141 turbine installations, reflecting the highest possible amount of activity that may occur in one year based on the schedule presented in the Air Permit Application. As noted above, for modeling purposes, Atlantic Shores assumed this level of emissions would occur for *all three years*. Thus, there is no artificial segmenting of the project.

e) The hours of pile driving per day do not impact the short-term emissions since the emissions presented for short-term durations represent peak hour emissions occurring continuously over the 3-year modeled period.

f) When calculating the total length of the construction period, the duration of WTG installation does not need to be added to the duration of foundation installation at each individual location. This is because one vessel can install a foundation at one location while a different vessel installs a WTG in another location where the foundation has already been constructed.

g) The emissions and source parameters for short-term modeling of Construction can be found in Appendix B of the Air Quality Dispersion Modeling Report.

h) The calculations in Appendix B to the Air Permit Application contain tables which show the individual activity groups, such as Foundation Installation or WTG

Installation, associated with Construction and Operations phases of the project. These calculations also show details of the individual vessels within each activity group, including the vessel engine count, vessel engine size, home port, trip count, trip distance, operating days in the Wind Turbine Area, engine load factor for each engine type and activity, and emissions factors used in determining the peak hour emission rate that feed into the application and the short-term modeling. Similar information is also located in Appendix B of the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application.

i) Modeling for comparison against NAAQS and PSD increments is in accordance with 40 CFR Part 51, Appendix W. Modeling of Air Quality Related Values (AQRVs) is in accordance with the Federal Land Manager's Air Quality Related Values Work Group (FLAG) Revised Phase I Report.

j) A description of several reasons why the modeling of Air Quality Related Values (AQRVs) is conservative can be found in the section titled "Conservatism" in Appendix C of the Air Quality Dispersion Modeling Report, which is Appendix C of the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application.

k) The forms of the $PM_{2.5}$ 24-hour NAAQS and $PM_{2.5}$ 24-hour Increment are different from each other. These are described in Table 3-1 and Table 3-2 respectively.
   - The $PM_{2.5}$ 24-hour NAAQS is the 98th percentile concentration averaged over three years,
   - The $PM_{2.5}$ 24-hour PSD Class I increment is the 24-hour maximum, not to be exceeded more than once per year.

l) The air quality dispersion modeling for the short-term $PM_{2.5}$ NAAQS and Increment were modeled assuming construction activities occurred at and around a single WTG location, continuously for a 3-year meteorological period, and as a result, it is highly conservative. The modeling results do not reflect an average of a single year of construction followed by two years of no construction emissions.

m) The air quality dispersion modeling for the short-term $PM_{2.5}$ NAAQS and PSD Increment considers continuous operation over each entire day, over the course of an entire year; including nighttime periods. This is despite the seasonal restrictions on pile driving, and thus, it is highly conservative.

n) Operations and Maintenance Emissions are described in Section 4.2 of the Air Quality Dispersion Modeling Report. The emission rates and source parameters modeled are in Appendix B of the Air Quality Dispersion Modeling Report.

o) The three years of meteorological data used for the Air Quality Dispersion Modeling analysis are described in Section 4.5 of the Air Dispersion Modeling Report. The project used prognostic data. The prognostic data is reflective of overwater meteorological conditions in the vicinity of the Projects. The representative analysis demonstrating the representativeness of the prognostic data can be found in Appendix E of the Air Quality Dispersion Modeling Report.

p) The air quality dispersion modeling analysis for the NAAQS and PSD Increment used AERMOD/AERCOARE. As described in Section 4.1 of the Air Quality Dispersion Modeling Report, a request was made to utilize AERMOD/AERCOARE instead of the Offshore Coastal Dispersion (OCD) model to EPA Region 2. The process used to document that the use of AERMOD/AERCOARE is acceptable is spelled out in 40 CFR Part 51 Appendix W Section 3.2.2(e). Approval was granted to use AEREMOD/AERCOARE provided a demonstration that shoreline fumigation is not a concern. The shoreline fumigation demonstration is included in Appendix D of the Air Quality Dispersion Modeling Report.

The Project's Clean Air Act Notice of Intent was submitted to EPA on December 22, 2021 and is published online at https://www.regulations.gov/document/EPA-R02-OAR-2024-0312-0024 an exceedance of NAAQS or PSD increment.

r) Table 2.3 of the New Jersey Regional Haze SIP (https://dep.nj.gov/airplanning/state-implementation-plans-sips/regional-haze-sip-2020/) indicates that the uniform annual rate of improvement required to achieve natural visibility (for the 20% most impaired days) by 2064 is 0.28 deciviews. This rate is based on the Uniform Rate of Progress (URP), also known as the glide path. The 0.28 deciview benchmark is not an annual requirement but rather a standard for evaluating progress against the Reasonable Progress Goal (RPG).

s) Figure 2-2 of the New Jersey Regional Haze SIP shows that the projected 2028 visibility at the Brigantine Wilderness Area is well below the URP level. Additionally, the figure indicates that the observed 2016 visibility at Brigantine is approximately 6 deciviews below the URP glide path. The average observed visibility from 2018-2022 (see figure below) shows more than 6 deciviews below the URP glide path. Therefore, any potential increases in visibility degradation at Brigantine due to the project would not endanger Brigantine's visibility remaining below the URP glide path and meeting the regional haze rule goals.

2.5 Uniform Rate of Progress

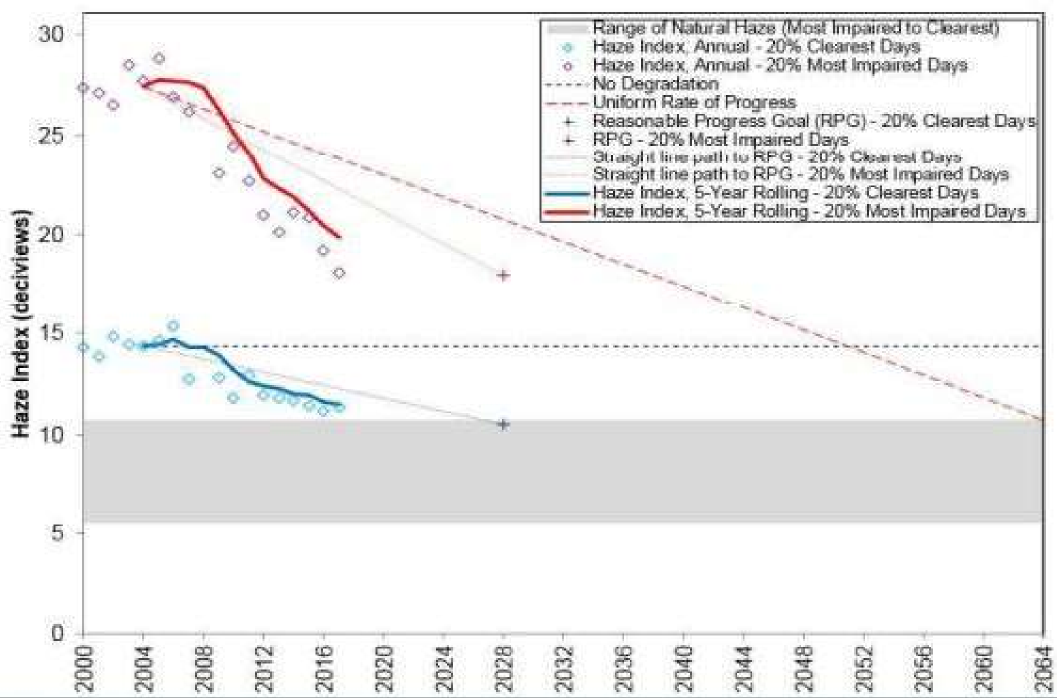
The uniform rate of progress (URP) defines, in deciviews per year, the rate of visibility improvement that would be maintained to attain natural visibility conditions by the end of 2064. The URP or glide path is represented in Figure 2-2 as a straight line between baseline conditions and 2064. DEP's calculations using most impaired days show the URP to be 0.28 deciviews per year. See Table 2-3. As seen in Figure 2-2, the reasonable progress goals established for 2028 at the Brigantine Wilderness Area are expected to provide visibility improvements at a greater rate than this rate.

Table 2-3: Uniform Rate of Progress for Brigantine Wilderness Area

2000–2004 Baseline Visibility (20% Most Impaired)	2064 Natural Visibility (20% Most Impaired Days)	Total Improvement Needed by 2028	Total Improvement Needed by 2064	Uniform Annual Rate of Improvement
27.43	10.69	6.72	16.74	0.28

The calculated URP line is drawn for the most impaired visibility days only. USEPA recommended in its draft guidance that states recalculate the value of the 2000–2004 baseline, or use an updated value provided by USEPA or the IMPROVE program. Figure 2-2 shows that Brigantine Wilderness Area is well below the 2018 URP level for the first SIP Planning period and currently below the 2028 URP level for the second planning period.

Figure 2-2: Visibility Metrics levels at Brigantine Wilderness Area



Response 5.23
EPA notes the clarifications made by the applicant above.

Section 6.0 – Class I Area Impact Review Conducted by the US Fish and Wildlife Service (US FWS)

Comment 6.1
The EPA, in its letter of December 1, 2022, indicated that the application would not be complete pending confirmation from the Fish and Wildlife Service (FWS) that it is satisfied with the impact analysis for the air quality related values at the Brigantine Wildlife Area. We have not seen such confirmation, again raising questions as to why the application was deemed complete and released for public comment. The FWS position on this application should be disclosed.

Response 6.1
The following response was provided by the United States Fish and Wildlife Service (US FWS):

> *On August 18th, 2023, the U.S. Fish & Wildlife Service (FWS) sent an email message to the Environmental Protection Agency, Region 2 air quality staff stating that we considered the Atlantic Shores - South air quality permit application complete. Though we agreed that the required portions of the permit application were present, the FWS followed a common practice of requesting the applicant to respond to additional questions or additional analysis requests into the future. We did participate with EPA, ask questions of the applicant, and review new materials as they were produced through the full permitting process. The FWS works with all applicants to minimize air quality impacts to Class I areas and public lands that we manage.*

Comment 6.2
There are differing assumptions for Air Quality Modeling versus Air Quality Related Values Modeling. They appear to be different approaches taken regarding the two sets of modeling. The application should explain why.

Response 6.2
The following response was provided by the US FWS:

> *The U.S. Fish & Wildlife Service follows the Federal Land Managers' Air Quality Related Values Work Group, Revised 2010 (FLAG) federal guidance document in how it evaluates impacts to Class I areas during air permit application review. Air Quality Related Values (AQRV) evaluation primarily looks at short-term visibility impairment and long-term aerosol deposition which differs from the human health standards EPA protects. We often use different models, timescales, and emission character layouts to better evaluate the AQRV impact. Though somewhat different from EPA's approach, the intent is to represent an applicant's activity in as consistent manner as possible.*

Clean Air Act regulations provide that the Federal Land Manager, in this case the US FWS, has the affirmative responsibility to protect the AQRVs in Class I areas, including visibility and deposition. Thus, modeling for the AQRVs assessed visibility and aerosol deposition, rather than compliance with NAAQS and PSD increment. The modeling for the AQRVs consisted of the following analyses: near field (<50km) plume visual impact analysis using the VISCREEN model, a more detailed plume visual impact analysis using the CALPUFF model, and deposition analysis which analyzed nitrogen and sulfur annual impacts using CALPUFF. While Response

5.19 explains that the AERMOD model was appropriate to use for modeling to demonstrate the air concentrations of criteria pollutants would not violate NAAQS or PSD increment, other models such as VISCREEN and CALPUFF are more appropriate to assess the impacts to visibility and aerosol deposition.

See Section 5.0 for an in-depth discussion of the assumptions made for the air quality modeling analyses conducted to demonstrate compliance with the NAAQS and PSD increment standards.

Comment 6.3
The EPA, and by extension, BOEM, need to take into consideration the cumulative effects of not only the Project's Atlantic Shores wind turbines, but also the wind turbines of the nearby Ocean Wind lease area, which is eligible to go back on the market for another lease, in addition to the NY Bight projects, as well as consider other BOEM leases in the surrounding area.

Brigantine, less than five miles from Atlantic City, unfortunately straddles all these projects, and **there is a total of more than 1,800 wind turbines now projected for the area.** *(Emphasis added by the commenter.)*

Response 6.3
For a discussion related to consideration of cumulative effects, including from the New York Bight projects, in modeling for NAAQS and PSD increment, *see* Response 5.18. With regards to the nearby Ocean Wind project, on February 29, 2024, BOEM approved Ocean Wind's request to suspend its lease until February 28, 2026. On May 22, 2024, pursuant to Ocean Wind's request, EPA suspended its review of Ocean Wind's air permit application, which was incomplete at the time. Thus, it is not necessary for Atlantic Shores to consider Ocean Wind impacts in its NAAQS and PSD increment modeling.

The effects of each nearby wind farm project on the NAAQS and PSD increment and on the Brigantine National Wilderness Area will be evaluated, including its cumulative effects with other nearby wind farms with issued OCS air permits or with complete OCS air permit applications, as OCS air permit applications come in for review.

Section 7.0 – Comments from Atlantic Shores Offshore Wind

Note that in addition to the comments below, Atlantic Shores provided clarifying statements related to its Air Quality Analysis that they wanted to include in the public record. These have been included at the end of Section 5.0 of this document. *See* Comment 5.23.

Comment 7.1
Comment regarding the specific draft OCS air permit condition below:

> **IV.A.1.a:** "During C&C, the three representative jack-up vessels identified in Table 1A to this permit that will be used for the WTGs installation activities, shall be the sole marine vessels authorized by this permit to operate as OCS source vessels, as the term is defined in this permit."

Jack-up vessels may be used during foundation installation and OSS installation activities as well as WTG installation activities. As described throughout the OCS Air Permit application submitted on June 26, 2024, including in Section 4.3.1, the modeled Project Design Envelope (PDE) of the Project includes the maximum design scenario for project components including installation techniques. For OSS installation, the modeled maximum design scenario utilizes a heavy lift vessel, but other possible scenarios use jack-up vessels instead. Application sections 1.2.4.2 and 3.1.1 explain that jack-up vessels can support OSS or WTG construction. The use of jack-up vessels in foundation installation activities is described in section 1.2.2.1 and included in Table 1-4 of the Air Permit Application.

Atlantic Shores proposes including the potential for jack-up vessel use in OSS and foundation installation activities by changing the condition to read: "the three representative jack-up vessels identified in Table 1A to this permit, which can be used for the WTG, foundation, and OSS installation activities, shall be the sole marine vessels authorized by this permit to operate as OCS source vessels…"

Response 7.1
The commenter is correct that the application states that jack-up vessels can be used to support OSS or WTG construction. This omission in the permit was an oversight on EPA's part. Therefore, the proposed change supports the original intention and adds more clarity to the permit condition.

EPA notes that using the jack-up vessel instead of the heavy lift vessel for OSS installation, as some scenarios in the application indicate, would result in actual lower air emissions. For purposes of modeling, Atlantic Shores modeled the worst-case scenario emissions, and thus assumed the use of the heavy lift vessel, rather than the jack-up vessel, for all OSS installations.

EPA agrees with the comment and has updated Condition IV.A.1.a. as follows:

a. *During C&C, the three representative jack-up vessels identified in Table 1A to this permit,* ***which will be used for installation activities related to the WTGs and/or OSSs and their foundations****,* ~~*that will be used for the WTGs installation activities*~~*, shall be the sole marine vessels authorized by this permit to operate as OCS source vessels, as the term is defined in this permit.*

Because of the above changes, EPA is also revising the relevant cell in Table 1A as follows to include OSS installation in the activity of the jack-up vessel:

Representative Vessel Types for WTG Installation (for both ASP1 and ASP2[a])	Activity/Vessel Description	Identified in Application as OCS Source? (Y/N)[b]	Marine Engines (per each vessel): Type (Main or Auxiliary), Number & Maximum Engine Power (in kW/engine)
Jack-Up Vessel	*WTG/**OSS** Installation*	*Y*	*Main engines (4): 3,535, all Category 3.* *Main engines (3): 2,650, all Category 3.* *Auxiliary engine (1): 2,650, Category 3.*

Comment 7.2
Comment regarding the specific draft OCS air permit condition below:

IV.A.1.e "Each jack-up vessel deployed by the Permittee shall be the vessel with the highest-tiered engines ("highest-tier vessel") that was available at the time the vessel was hired for the specific work required in the timeframe required. The Permittee may only hire and deploy an available vessel with the next highest-tier engines, if the Permittee documents the basis for its conclusion that the highest-tier vessel, and any other higher-tiered vessels, are not available. [40 C.F.R. § 52.21; N.J.A.C. 7:27-18.3(b)(1)]"

a. Atlantic Shores proposes defining the term "available" by adding the sentence "A vessel is available if the Permittee determines it is capable of conducting the work required by the contract and was available for hire for the full timeframe in which the work is expected to be conducted."

b. Atlantic Shores also proposes that this condition include language such that vessels with lower-tiered engines may be used if the total emissions associated with the use of the lower-tiered vessel are the same or lower than the total emissions that would result from the highest-tiered vessel available. Such conditions have been included in the OCS Air Permits of Coastal Virginia Offshore Wind, Sunrise Wind, Revolution Wind, Vineyard Wind I, South Fork Wind, and New England Wind I.
The completed proposed condition is:

IV.A.1.e Each jack-up vessel deployed by the Permittee shall be the vessel with the highest-tiered engines ("highest-tier vessel") that was available at the time the vessel was hired for the specific work required in the timeframe required. The Permittee may only hire and deploy an available vessel with the next highest-tier engines if either of the following conditions are met:

i. *the Permittee documents the basis for its conclusion that the highest-tier vessel, and any other higher-tiered vessels, are not available. A vessel is available if the Permittee determines it is capable of conducting the work required by the contract, and was available for hire for the full timeframe in which the work is expected to be conducted; or*
ii. *the total emissions associated with the use of a vessel with the higher Tier engine(s) would be greater than the total emissions associated with the use of the vessel with the next lower Tier engine(s). For purposes of this subparagraph, when determining the total emissions associated with the use of a vessel with a particular engine, the Permittee shall include the emissions of the vessel that would occur when the vessel would be in transit to the WDA from the vessel's starting location [40 C.F.R. § 52.21; N.J.A.C. 7:27-18.3(b)(1)]*

Response 7.2
The commenter requests two changes to Condition IV.A.1.e. in the permit. This condition of the permit requires that Atlantic Shores contract with "the vessel with the highest-tiered engines ('highest-tier vessel') that was available at the time the vessel was hired for the specific work required in the timeframe required." The first change that the commenter requests is that the

permit language be revised to define an “available” vessel as one “capable of conducting the work required by the contract and was available for hire for the full timeframe in which the work is expected to be conducted.”

EPA agrees with the commenter that a vessel that is available for “the specific work required” is a vessel that is capable of conducting the work required by the vessel contract. With regards to when a vessel is available for “the timeframe required,” this timeframe will depend on the specifics of the work required. Depending on the work, it may be that precise dates of availability are needed, or that work must be done in a general timeframe but that the precise timeframe contains some flexibility. In general, the timeframe for which Atlantic Shores has sought contract bids is likely to reflect the specific project’s needs, and EPA would expect such requests for bids to be retained under the permit’s recordkeeping requirements. The EPA believes that the required timeframe may often coincide with the timeframe in the contract with the hired vessel, if it is planned and contracted out with sufficient lead time. However, for example, if hypothetically Atlantic Shores seeks to hire a vessel for long-term needs during O&M, and is choosing between a cleaner jack-up vessel available for 3 years and a dirtier vessel available for 4 years, given that the O&M phase is expected to last 30 years, EPA would generally consider both to be available for the timeframe needed. Under Condition IV.A.1.e. we expect that each time the permittee contracts an OCS source vessel, for use either during the C&C phase or during the O&M phase throughout the operational life of the project, it would select the highest-tiered vessel (lowest polluting vessel) available at that time, taking into account any project timing flexibilities; a vessel not being available for the exact timeframe in the contract is not necessarily a reason for selecting a higher polluting vessel without further justification. EPA does not believe the draft permit language requires additional clarification. Thus, EPA is not making this suggested change in Condition IV.A.1.e.

The second change the commenter seeks is a revision to Condition IV.A.1.e. to allow consideration of emissions from vessels while transiting from their starting locations to the Wind Development Area as a basis for using a vessel with lower-tiered engines as opposed to the vessel with the highest-tiered engines that was available at the time the vessel was hired by Atlantic Shores.

Condition IV.A.1.e. of the draft permit requires that, for the 3 (during C&C) and 4 (during O&M) marine vessels that will be OCS sources, Atlantic Shores must hire (contract) the available vessel with the highest-tiered engines (“highest-tier vessel”). Atlantic Shores may only hire and deploy an available vessel with the next highest-tiered engines, if the Permittee documents the basis for its conclusion that the highest-tier vessel, and any other higher-tier vessels, are not available. Condition X.8.c. of the draft permit contains related recordkeeping requirements. EPA considers the requirement to use the highest-tier vessel to be part of the BACT and LAER requirements for this permit. Note that, for purposes of Condition IV.A.1.e., the tiers referred to are the engine tiers established in the 40 C.F.R. Part 1042 Tier emission standards (expressed as g/kW-hr), or equivalent international emission standards acceptable to EPA.

EPA has considered the commenter’s second request and has concluded that the requested change is unwarranted. For this particular project, this permit condition applies specifically to the jack-up vessels that will be the only OCS source vessels for this project, which are large vessels with emissions that compose roughly half of the project's C&C phase emissions that were modeled for impacts to communities onshore and the Brigantine National Wilderness Area (Class I Area). Vessel emissions while transiting from a starting point to the Wind Development Area may occur at a considerable distance from the project and may not impact the above-mentioned areas of concern.

Furthermore, particularly given the project's large size and proximity to shore and to a Class I Area, it is important that the permit conditions be protective of the onshore communities and of the Brigantine National Wilderness Area and, where possible, reduce actual emissions of air pollutants at and near the OCS Facility as much as possible, even if expected modeled emissions would not cause a violation of NAAQS or PSD increment. Ensuring that OCS source vessels that are chosen will have the lowest emissions at and near this OCS Facility is an appropriate BACT and LAER requirement. Allowing vessels with lower-tiered engines (higher emitting) to be chosen for this project based on lower total emissions from transiting from starting locations to the work site, where impacts (from either the cleaner or dirtier vessel) from such transiting air emissions may occur the open sea at considerable distances from the OCS Facility and thus may have no impact on the areas of concern, would provide less protection for the local Class I Area and onshore communities.

Comment 7.3
Comment regarding the specific draft OCS air permit condition below:

IV.A.4.a-d and IV.A.5.f-i: Category 3 Marine Engine NO_x emission limits of either 10.03 g/kW-hr or 11.55 g/kW-hr

Per page 26 of 67 of the draft Fact Sheet, Category 3 engines (engines with displacement ≥30 L/cyl) must meet the requirements of NSPS IIII. The NSPS IIII requirements differ for Category 3 engines as they do not directly point to the tier standards in 40 CFR 1042 as is the case for engines with displacement <30 L/cyl (Category 1 and 2 engines). For Category 3 engines, the NSPS directly incorporates the specific emissions limits consistent with those tier standards, based on applicable engine install year, into the specific engine requirements rather than incorporating them by reference. As such, consistent with the limits for Category 1 and 2 engines, and consistent with the monitoring requirements in the draft permit, we propose Category 3 engines to be limited to Tier 2 or better, which aligns with the specific NSPS Subpart IIII emissions requirements for engines with displacement ≥30 L/cyl found at 40 CFR 60.4204(c) (specifically 40 CFR 60.4204(c)(2) for NO_x). We propose language changes consistent with the other parts of the permit, and (consistent with other parts of the permit) a numerical NO_x emission limit consistent with the maximum Tier 2 emission limit as presented in both 40 CFR 1042 and NSPS IIII for Category 3 engines of 14.4 g/kW-hr. The actual limit will be dependent on final engine configuration, since the applicable Tier 2 emissions standard for each engine is based on its maximum speed. This comment is repeated for all Category 3 engine limits.

Response 7.3
This comment concerns permit requirements for the Category 3 marine engines (which are compression ignition internal combustion engines) that will be on the project's OCS source vessels during the C&C and O&M phases. Category 3 marine engines are marine engines with a

displacement of equal to or greater than 30 Liters/cylinder.

The draft permit contained NSPS IIII NO_x emission standards for Category 3 marine engines of 10.03 g/kW-hr[7] and 11.55 g/kW-hr[8], which also constitute the BACT and LAER emission limits (g/kW-hr)[9] for the same engines. The commenter requests that the draft permit's NSPS IIII, BACT and LAER limits be changed to 14.4 g/kW-hr. The commenter refers to the following draft permit conditions: IV.A.4.a, 4.b, 4.c, and 4.d, and IV.A.5.f, 5.g, 5.h, and 5.i.

NSPS IIII and its requirements include a NO_x emission standard that applies to each Category 3 engine on the project's OCS source vessels; that emission standard varies based on the engine's installation date and maximum engine speed in revolutions per minute ("rpm"), which is information that Atlantic Shores represented was not known at the time of the application. For example, for engines installed on or after January 1, 2012, and before January 1, 2016, the NO_x emission standard can range from 7.7 g/kW-hr for engines with equal to or greater than 2,000 rpm, up to 14.4 g/kW-hr for engines with less than 130 rpm (the least stringent standard for engines meeting the above-listed criteria). *See* 40 C.F.R. § 60.4204(c)(2).

The permit requires that each Category 3 marine engine of an OCS source vessel meet the NSPS IIII NO_x emission standards that apply to that engine based on its actual installation date and rpm, but that, for reasons explained below, these standards shall be no less stringent than 10.03 and 11.55 g/kW-hr, for auxiliary and main (or propulsion) engines respectively.

Since the Category 3 marine engines of the project's OCS source vessels are marine engines, they will also need to be certified to the relevant Tier emission standards for NO_x, CO, and HC in 40 C.F.R. Part 1042 ("Control of Emission from New and In-Use Marine Compression-Ignition Engines and Vessels") ("Part 1042"). Part 1042 includes three tiers of emission standards (Tier 1 through 3), which vary depending on the engine's model year and maximum in-use engine speed, expressed in rpm. For example, the Tier 2 NO_x emission standards in Part 1042 for Category 3 engines apply for model years 2011-2015 and range from 7.7 g/kW-hr for engines with greater than 2,000 rpm, up to 14.4 g/kW-hr for engines with less than 130 rpm (the least stringent standard). *See* Table 1 to 40 C.F.R. § 1042.104(a)(2) ("NO_x Emission Standards for Category 3 Engines").

The permit requires that each actual Category 3 marine engine on an OCS source vessel used for this project be certified to at least the Tier 2 emission standards of Part 1042. The reason for requiring the use of Category 3 marine engines that are certified to at least Part 1042's Tier 2 emissions standards is that the Tier 2 emission standards for CO and HC were used to set the BACT emission limit for CO and the LAER emission limit for VOC.

Note that unlike for Category 1 and 2 marine engines, the requirements of NSPS IIII do not allow compliance with the NSPS IIII NO_x emission standards for Category 3 marine engines to be demonstrated via certification to Part 1042 Tier NO_x emission standards. In accordance with

[7]10.03 g/kW-hr of NO_x corresponds to Category 3 auxiliary marine engines.
[8]11.55 g/KW-hr of NO_x corresponds to Category 3 main or propulsion marine engines.
[9]EPA has determined that for Category 3 marine engines, BACT and LAER for NO_x is the level of control provided by NSPS IIII, and thus the NSPS IIII NO_x emission standards become the BACT and LAER NO_x emission limits.

NSPS IIII, the permit requires that performance testing shall be conducted to demonstrate compliance with the NSPS IIII emission standards and BACT and LAER emission limits for NO_x specified in the permit for Category 3 marine engines of OCS source vessels.

In its application, Atlantic Shores used emission factors of 10.03 g/kW-hr for Category 3 auxiliary engines and 11.55 g/kW-hr for Category 3 main (or propulsion) engines[10], in combination with the assumed representative engine power (in kW), engine load factor, and engine hours of operation, to calculate the tons per year ("tpy") and grams/second ("g/s") of NO_x emissions that would result from each of the Category 3 marine engines on OCS source vessels. These NO_x emissions calculations were then used in the air quality impact analyses and in determining major NSR applicability, maximum NO_x daily emission rates, compliance with the NO_2 NAAQS and NO_2 PSD increment, and in determining the number of NO_x offsets required for the project.

The 10.03 g/kW-hr and 11.55 g/kW-hr NO_x emissions limits in the permit are consistent with the permit application and they fall within the range of both the NSPS IIII NO_x emission standards for such engines installed on or after January 1, 2012, and before January 1, 2016, and the Part 1042 Tier 2 NO_x emission standards for such engines discussed above.

By contrast, using the higher 14.4 g/kW-hr NO_x emission limit suggested by the commenter as the permit's NSPS IIII NO_x emission standard and BACT and LAER NO_x emission limits for Category 3 marine engines onboard OCS source vessels would match the least stringent NSPS IIII NO_x emission standard and Part 1042 Tier 2 NO_x emission standard for Category 3 engines. However, the applicant did not submit to the EPA for review an air quality impact analysis of NO_x emissions calculated based on 14.4 g/kW-hr. Therefore, allowing for a 14.4 g/kW-hr NO_x emission limit would be inconsistent with the NO_x emissions factors (g/kW-hr) of 10.3 and 11.55 g/kW-hr used in the application for the air quality impact analyses, which showed compliance with the NAAQS for NO_2 and NO_2 PSD increment and that the EPA had relied on to determine the maximum daily NO_x emission rate in the permit and major NSR applicability, among other things. Finally, the amount of NO_x offsets that the Permittee is required to obtain in order to offset its project NO_x emission increases were not based on the 14.4 g/kW-hr of NO_x.

We agree with the commenter that for Category 1 and 2 marine engines of OCS source vessels (which have a displacement of less than 30 Liters/cylinder), the BACT and LAER NO_x emission limits (g/kW-hr) established in the permit are derived from the minimum Part 1042 Tier 2 emission standard for NO_x + Total Hydrocarbons ("THC"). (Note that Part 1042 Tier 2 does not include an emission standard for Category 1 and 2 engines for NO_x alone.) Unlike for Category 3 marine engines, Category 1 and 2 marine engines are able to comply with NSPS IIII by using engines certified to comply with Part 1042 Tier 2 emission standards. And, unlike for Category 3 marine engines, the BACT and LAER emission limits for NO_x (g/kW-hr) included in the permit for the Category 1 and 2 marine engines are more stringent than the NO_x (g/kW-hr) emission factor[11] used in the application to calculate tpy and g/s of NO_x emissions resulting from those

[10]The 10.03 g/kW-hr and 11.55 g/kW-hr of NO_x represent the BOEM Wind Tool emission factors that the applicant selected to use for its Category 3 marine engines.
[11]The NO_x g/kW-hr emission factor used in the application for Category 1 or 2 marine engines represents the BOEM Wind Tool emission factor that the applicant selected to use for its Category 1 or 2 marine engines.

engines, numbers that were then used in air quality impact analyses and for major NSR applicability determination purposes.

Based on the above discussion, EPA has concluded that the requested change is unwarranted.

Comment 7.4
Comment regarding the specific draft OCS air permit condition below:

IV.B.1.b: $PM_{2.5}$ limit of 0.01 g/kW-h

Consistent with $PM_{2.5}$ limits throughout the permit, we propose changing this limit to 0.02 g/kW-hr. According to the methodology used elsewhere in the permit, $PM_{2.5} = PM_{10}*.92$, which would be 0.018 g/kW-hr, rounding to 0.02 g/kW-hr.

Response 7.4
Permit condition IV.B.1.b in the draft permit provides, *inter alia*, the $PM_{2.5}$ BACT emission limit for non-marine diesel generator engines used during both the C&C and O&M phases. This condition also sets BACT emission limits for PM and PM_{10}.

Under NSPS IIII, these non-marine engines must be certified to a PM emission standard of 0.02 g/kW-hr; this limit serves as the basis for the BACT emission limit for PM. EPA derived both the PM_{10} and $PM_{2.5}$ limits from the PM emission limit. Based on a July 2010 EPA technical report entitled "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition,"[12] and consistent with how PM_{10} and $PM_{2.5}$ emissions for non-marine engines have been derived in other OCS air permitting actions, EPA first assumed that all PM emissions will be smaller than 10 microns (PM_{10}), and thus set a PM_{10} BACT emission limit of 0.02 g/kW-hr for non-marine engines in condition IV.B.1.b equivalent to the conditions' emission limit for PM.

Then, again based on the July 2010 report and prior permitting actions' approaches, the $PM_{2.5}$ BACT emission limit in the permit was derived from the PM_{10} BACT emission limit by assuming that 97% of the PM_{10} emitted would be $PM_{2.5}$. 97% of the PM_{10} BACT emission limit of 0.02 g/kW-hr is 0.0194 g/kW-hr. EPA truncated this value to establish a 0.01 g/kW-hr $PM_{2.5}$ BACT emission limit in the permit. However, EPA recognizes that it is also justifiable to round this value up to 0.02 g/kW-hr. And EPA notes that the permit requires that compliance with the PM, PM_{10} and $PM_{2.5}$ BACT emission limits be demonstrated via EPA certification to the applicable NSPS IIII PM emission standard. Thus, revision in the permit of this $PM_{2.5}$ BACT emission limit from 0.01 to 0.02 g/kW-hr will not result in an actual change in engine emissions. We have made this change in the final permit as requested by the commenter.

Finally, we note that the methodology of determining $PM_{2.5}$ emissions by multiplying PM_{10} by 0.92 that the commenter refers to, is indicated in the permit as the methodology to be used for diesel marine engines, not for the non-marine engines covered under condition IV.B.1.b.

---

[12]This document is report number NRD-009d and is available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10081UI.pdf.

The $PM_{2.5}$ emission limit in Condition IV.B.1.b. is revised as follows:

Maximum Engine Power	*NO_x (g/kW-hr)*	*VOC (g/kW-hr)*	*CO (g/kW-hr)*	*PM (g/kW-hr)*	*PM_{10}* (g/kW-hr)*	*$PM_{2.5}$* (g/kW-hr)*
130 ≤ kW ≤ 560	*0.40*	*0.20*	*3.5*	*0.02*	*0.02*	*0.0~~1~~**2***

Comment 7.5

Comment regarding the specific draft OCS air permit condition below:

IV.D.2.a.1: "On a monthly basis, the Permittee shall calculate and record the tons of monthly CO_2e emitted by the SF_6-insulated electrical switchgears combined, by using mass balance and accounting for leakage periods and by converting the SF_6 emissions to CO_2e based on the Global Warming Potentials ("GWP") listed in Table A-1 to 40 C.F.R. Part 98, Subpart A."

The SF_6 insulated electrical switchgears have very low rates of emissions from losses. We request that EPA consider changing this requirement to an annual calculation or coinciding with the OEM's [Original Equipment Manufacturer's] recommended scheduled maintenance schedule for the electrical switchgear.

Response 7.5

The SF_6-insulated electrical switchgears on the OSSs and WTGs will emit sulfur hexafluoride ("SF_6")[13], which is a GHG and is subject to BACT requirements for GHG emissions. The permit establishes a BACT GHG emission limit of 3,519 tons of CO_2e on a 12-month rolling total basis[14] for all of the SF_6-insulated electrical switchgears combined. *See* Condition IV.D.1.a. in the permit.

Conditions IV.D.2.a.1. and a.2. in the permit specify the calculation method to use to determine the actual tons of CO_2e emitted from SF_6 emission leaks during each rolling 12-month period, which the Permittee shall use to verify compliance with the BACT emission limit for CO_2e. Condition IV.D.2.a.1. requires that the Permittee calculate and record, each month, the actual tons of CO_2e emitted from all SF_6-insulated electrical switchgears combined. Then, Condition IV.D.2.a.2. requires that this monthly total tons of CO_2e be added to the monthly total tons of CO_2e for the previous 11 months to get the 12-month rolling total tons of CO_2e. This calculated 12-month rolling total tons of CO_2e is then used by the Permittee to verify compliance, each month, with the permit's BACT CO_2e emission limit for all of the OSSs' and WTGs' SF_6-insulated electrical switchgears combined.

The commenter requests that Condition IV.D.2.a.1. be revised so that the Permittee calculates and records the actual tons of CO_2e resulting from all SF_6-electrical switchgears combined either

[13]Sulfur hexafluoride (SF_6) is a synthetic fluorinated compound with an extremely stable molecular structure. It is also the most potent greenhouse gas known to date. Over a 100-year period, SF_6 is 22,800 times more effective at trapping infrared radiation than an equivalent amount of carbon dioxide (CO2). SF_6 is also a very stable chemical, with an atmospheric lifetime of 3,200 years.

[14]SF_6 emissions are converted to CO_2e.

(1) annually, rather than monthly; or (2) to coincide with the original equipment manufacturer's recommended maintenance schedule for the SF_6-insulated switchgears. The commenter did not provide details of such a schedule. The commenter also did not make any claim that it cannot comply with Conditions IV.D.2.a.1. and a.2. in the draft permit as written.

The draft permit's BACT limit on tons of CO_2e on a 12-month rolling total basis, along with its monitoring method, is appropriate as BACT for SF_6 emission sources such as the SF_6-insulated switchgears, is practically enforceable, and is consistent with previous OCS air permitting.[15]

To the extent the comment requests a change to the method of verifying compliance and not a change to the emission limit itself, making such a calculation only once a year to verify compliance with a 12-month rolling average limit is not acceptable. It will not enable verification of compliance with the relevant 12-month rolling emission limit, which applies monthly. An air permit must designate a tool for verifying compliance with a BACT emission limit or a limit on an emission source's potential to emit that is consistent with the way the limit is expressed. With regards to the commenter's alternative suggestion that the permit allow compliance to be measured at an interval consistent with an undefined maintenance schedule recommended by an undefined manufacturer, we cannot tell at this time whether such a schedule would align with compliance demonstration at an adequate frequency, and we are not aware of provisions in the CAA or its implementing regulations supporting deference to an undefined manufacturer's recommendation as a permit's compliance methodology for a BACT limit of this type.

To the extent that the commenter in fact meant that the BACT CO_2e emission limit should be expressed as tons per year rather than as tons on a 12-month rolling total basis, EPA notes that such a limit is not acceptable as a BACT emission limit or a permit limit on an emission source since such a long averaging time would not readily allow for determination of compliance (i.e., one would have to wait for another year to pass to determine compliance again), thus making such a permit limit not practically enforceable as per EPA guidance.[16]

Based on the above rationale, no change to Condition IV.D.2.a.1. was made based on this comment.

Comment 7.6

Comment regarding the specific draft OCS air permit condition below:

IV.D.2.d: "perform maintenance on an SF_6-insulated electrical switchgear to fix seals as soon as practicable but no later than 5 days after the pressure drop is detected"

It is expected that dangerous weather conditions could prevent crews from conducting

[15] *See* OCS air permit issued by EPA for Empire Wind, *available at* https://www.epa.gov/system/files/documents/2024-02/final-permit.pdf.

[16] *See*, EPA, New Source Review Workshop Manual, at B.56 (Oct. 1990); *see also*, EPA's June 13, 1989 "Guidance on Limiting Potential to Emit in New Source Permitting", which can be found at https://www.epa.gov/sites/default/files/2015-07/documents/lmitpotl.pdf, and EPA's March 13, 1992 memorandum John B. Rasnic to David Kee entitled "Policy Determination on Limiting Potential to Emit for Koch Refining Company Clean Fuels Project," which can be found at https://www.epa.gov/sites/default/files/2015-07/documents/koch_ref.pdf.

maintenance for periods of up to 14 days. A requirement to fix equipment at the soonest weather-permitting accessible day or within 14 days after the pressure drop is detected would be more appropriate.

Response 7.6

Commenter requests that EPA provide an exception to the maximum time provided in the permit to fix leaks of SF_6 at SF_6-insulated electrical switchgears (switches and bus ducts) from 5 days to up to 14 days after the leak is detected, during dangerous weather-related events, arguing that the potential for dangerous conditions makes such a change appropriate.

In considering this request, EPA recognizes that dangerous weather-related events such as high winds, storms, fog, heavy seas, and extreme temperatures, to name a few, can create hazardous conditions for the safety of the maintenance crew. EPA does not want to encourage unsafe activities by this permit condition and also recognizes that during these dangerous weather-related events, keeping the supply of electricity flowing is the most critical. Therefore, EPA is extending the repairs from 5 days to up to 14 days from the initial detection of a leak during these exceptional weather-related events, but expects repairs to be timely conducted once the dangerous weather conditions subside. However, this change will not affect the existing maximum annual allowable SF_6 emission losses stipulated in the permit; EPA is leaving that permit limit unchanged. EPA is revising Condition IV.D.2.d as follows:

> *Upon a detectable pressure drop that is 10 percent of the original pressure (accounting for ambient air conditions) for any switch or SF_6 gas-insulated bus duct, perform maintenance on an SF_6-insulated electrical switchgear to fix seals as soon as practicable but no later than 5 days after the pressure drop is detected. If repair or replacement cannot occur within 5 days of the detected leak, then the Permittee shall divert power from the affected electrical switchgear(s) and isolate the leak until the repair or replacement can be performed.* ***If repair or replacement cannot occur within 5 days of the detected leak because dangerous weather conditions prevent the repair within that period, then: 1) the Permittee shall fix seals at the soonest weather-permitting accessible day but no later than 14 days after the pressure drop is detected; and 2) if the repair cannot occur within 14 days of the detected leak then the Permittee shall divert power from the affected electrical switchgear(s) and isolate the leak until the repair or replacement can be performed.*** *The Permittee shall document and maintain records of the equipment repaired or replaced, including but not limited to, the estimated time of leakage and volume of gas leaked during that time,* ***as well as records and documentation of any claim(s) that dangerous weather delayed repair or replacement****. [40 C.F.R. § 52.21]*

Comment 7.7

Comment regarding the specific draft OCS air permit condition below:

IV.G.1. and IV.I.1: Facility-Wide 12-Month Rolling and Daily Emission Limits for SO_2

As stated in the footnotes of Tables 6 and 7 of the Draft Permit, SO_2 emissions do not trigger PSD review. We do not believe it is necessary or appropriate to limit SO_2 emissions in the permit beyond a requirement to remain under the PSD Significant Emission Rate (SER) of 40 tons per year. That said, 12-month rolling total emissions limits would be appropriate based on precedent from other OCS air permits.

It is our understanding that the daily and 12-month rolling SO_2 limits in the Draft OCS Air Permit were derived from the AQRV model inputs, but SO_2 was only included in AQRV modeling analyses for completeness, and it was expected that the minimal emissions would not significantly contribute to modeled AQRV impacts. To confirm our expectation, Atlantic Shores has re-run the prior CALPUFF visibility analyses assuming a 40 TPY annual SO_2 significant emission limit. This assumption results in modeled emission rate of 14.5 times the expected worst case emission rate. The results of the re-analyses with the assumed higher emission rates are presented below in the same table format for comparison to the original results (which are Tables 6 and 7 of the Class Air Quality Related Values Modeling Report submitted with the permit application), also provided below.

Reported in February 2024

Table 6. Visibility – Normal O&M Activities

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	1.5%	0	0	0.14	0	0
2019	1.1%	0	0	0.11	0	0
2020	1.8%	1	0	0.18	1	0

Table 7. Visibility – Normal O&M Activities Plus Major Turbine Repair Plus IAC Repair

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	3.5%	3	0	0.35	3	0
2019	3.1%	0	0	0.30	0	0
2020	4.5%	7	2	0.44	7	1

New results using July 2024 SO2 emissions (14.5 times higher than in February 2024 runs)

Table 6. Visibility – Normal O&M Activities

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	1.5%	0	0	0.15	0	0
2019	1.1%	0	0	0.11	0	0
2020	1.8%	1	0	0.18	1	0

Table 7. Visibility – Normal O&M Activities Plus Major Turbine Repair Plus IAC Repair

Modeled Year	98th percentile 24-hour change in light extinction	Number of days with extinction change > 5%	Number of days with extinction change > 10%	98th percentile 24-hour delta-deciview	Number of days with delta-deciview > 0.5	Number of days with delta-deciview > 1.0
2018	4.0%	4	0	0.39	3	0
2019	3.2%	1	0	0.32	0	0
2020	4.5%	7	2	0.45	7	2

These results confirm our expectation and conclusively demonstrate that SO_2 emissions, at expected actual worst case or at the much higher assumed emission rates, will not contribute significantly to modeled visibility impacts and are consistent with the conclusion in the submitted modeling report which states, on page 8 of the report:

"For normal O&M as well as normal O&M occurring simultaneously with major turbine repairs and Inter-Array Cable (IAC) repair, the 5% visibility extinction threshold for the 98th percentile is not exceeded for any of the 3 years (Table 6 and Table 7)."

It is our opinion that it is not necessary or appropriate to include short-term (tons/day) SO_2 limits, and we request their removal. If a short-term limit is determined to be necessary, we propose 0.11 tons/day as supported by the revised AQRV analysis.

Response 7.7
EPA is retaining a daily SO_2 limit in this permit. We consider it necessary and appropriate to keep this emission limit at this time because Atlantic Shores modeled SO_2 impacts, and the daily SO_2 limit is intended to ensure that the project is conducted in alignment with the submitted air quality analyses, including analyses related to the AQRVs that was submitted to US FWS, the Federal Land Manager for this project with whom EPA coordinates. The FLM has informed EPA that the revised visibility tables that the commenter submitted in this comment are insufficient to inform a technical recommendation on the commenter's request. Additional analysis may be required. *See* Response 7.12 for additional discussion.

The SO_2 ton per day limits in the permit were based on short-term emissions rates provided in Appendix B ("Model Inputs") to the Air Quality Dispersion Modeling Report. To establish these limits for the C&C phase, for each activity in the modeling for short-term NAAQS and increment (i.e., foundation installation, OSS installation, foundation scour protection, inter array cable installation, inter array cable pre-lay, inter-array cable scour protection, WTG installation, and transit), the peak hour SO_2 emission rates (in grams per second) for each vessel/emission point modeled for that activity were summed together. Then, the summed grams per second value was converted to ton per day. Finally, the ton per day value for each activity in the construction modeling was added together. A similar process was repeated for the O&M phase.

EPA acknowledges the updated modeling performed with CALFUFF that was submitted during the public comment period. However, given the information before it, EPA believes Atlantic Shores is able to comply with the daily SO_2 emission limits included in the draft permit. As Atlantic Shores states in the "Additional Clarification" section of its comments document, "For all construction activities, short-term model input emission rates, in units of grams per second, were generated for the peak hour and assumed to run 24 hours per day for all short-term model runs, which is a conservative approach." The ton per day value is based on short-term modeling that used a conservative approach, and the actual construction activities are not expected to operate continuously for 24 hours per day. Thus, if Atlantic Shores operates below the peak emission rates provided in the application, it should be able to comply with the ton per day limit.

Furthermore, the daily SO_2 emission limits from the draft permit are not simply the ton per year limit divided by 365 days, but rather have an additional buffer built in to provide Atlantic Shores flexibility. For example, if the emission limit of 0.05 tons of SO_2 per day is multiplied by 365 days, it provides a value of 18.25 tons per year. 18.25 is approximately 4.45 times greater than the permit's 12 month rolling total SO_2 emission limit of 4.1 tons. Also, please *see* Response 7.12.

We note that the alternative SO_2 limit of 0.11 ton of SO_2 per day suggested by the commenter would be equivalent to a potential to emit of 40.15 tons/year, triggering PSD review for SO_2. Such a change would thus not be appropriate at this time, and we do not have sufficient information to process any other alternative increase from the draft permit's limit of 0.05 ton of SO_2 per day. Consequently, we have decided to maintain the original limit of 0.05 ton per day in the permit. However, this does not prevent the Permittee from revisiting this issue in the future as a permit modification with the submittal of additional air modeling analysis and/or other potential mitigation measures, if required.

Comment 7.8

Comment regarding the specific draft OCS air permit condition below:

V.2: "For each marine engine of any jack-up vessel that is an OCS source, the Permittee shall conduct a one-minute visible emissions survey of the engine's emission points, each day during C&C and O&M that the engine operates."

Atlantic Shores proposes that "the Permittee shall conduct a one-minute visible emissions survey of the engine's emission points, weekly during C&C and O&M that the engine operates."

Response 7.8

Condition V.2 of the draft permit requires the Permittee to use EPA Method 22[17] to conduct a one-minute visible emissions survey of the emission point(s) for each marine engine on the 3

[17]EPA Method 22 is a qualitative technique that checks only the presence or absence of visible emissions.

OCS source vessels used at different times during C&C and the 4 OCS source vessels used at different times during O&M, for each day that the marine engine operates. Condition V.2 also requires that (a) if visible emissions from an emissions point are observed, the Permittee initiate corrective action within 8 hours of the observation, and (b) if the visible emissions persist following corrective action, the permit requires that the Permittee perform an EPA Method 9 visual determination of opacity in accordance with 40 C.F.R. Part 60, Appendix F, within 24 hours of the initial observation. The draft permit's requirements for daily visible emissions tests are in line with other OCS air permits previously issued by EPA for other wind farm projects, which have also required daily visible emissions tests for marine engines of OCS source vessels.[18]

The commenter proposes that these visible emissions surveys be conducted weekly when relevant marine engines are used during the C&C and O&M phases, as opposed to each day the marine engine operates. The commenter requests this change without further support or explanation for the request.

The daily visible emissions surveys required by the permit play an important role in assessing and assuring compliance with the opacity limits. Visible emissions surveys are quick to perform, are used to determine if visible emissions are present that must be addressed, and are part of the process for determining if formal observations must be conducted using EPA Method 9. Conducting these surveys daily will make the Permittee immediately aware of the presence of visible emissions, and the Permittee can then assess the situation and take measures to correct the issue causing the occurrence of visible emissions. In this way, daily surveys are monitoring measures meant to prevent and minimize the amount of air pollution released into the atmosphere by the marine engines on the OCS source vessels. If the visible emissions survey were to be conducted weekly instead of each day the marine engine operates, it would take longer for the Permittee to become aware of the presence of visible emissions, delaying any corrective actions and, during that time, the opacity limit might be exceeded.

EPA also notes that opacity is often an indicator of a level of particulate matter ("PM") emissions. Each of the marine engines of the OCS source vessels that are subject to the visible emissions survey requirement is also subject to BACT PM emission limits.

EPA has considered the comment but has determined that the requested change is unwarranted.

Comment 7.9

Comment regarding the specific draft OCS air permit condition below:

V.2.a: "For emission points where visible emissions are observed, the Permittee shall initiate corrective action within no more than eight hours of the initial observation."

Atlantic Shores proposes that "the Permittee shall initiate corrective action within no more than 24 hours of the initial observation," which is reasonable to give morning crews enough time to

[18]*See* OCS air permits issued by EPA for South Fork, Revolution Wind, Sunrise, New England 1 and New England 2, which can be found at https://www.epa.gov/caa-permitting/epa-issued-caa-permits-region-1, and the OCS air permit issued by EPA for Empire Wind, which can be found at https://www.epa.gov/system/files/documents/2024-02/final-permit.pdf.

evaluate the situation and determine what corrective action is needed.

Response 7.9

EPA has considered this comment and has updated Condition V.2.a. as indicated below. We acknowledge the challenges of implementing a corrective action at nighttime when the initial visible emissions observation occurred close to the waning daylight hours. We are thus granting the commenter's request that corrective action be initiated within no more than 24 hours of the initial observation, instead of 8 hours, but only if the ability to initiate and complete a corrective action within 8 hours is compromised by the inability to complete the repairs within the remaining daylight hours of that day. We believe that the updated condition addresses the commenter's concerns, while ensuring an adequate monitoring requirement.

> *For emission points where visible emissions are observed, the Permittee shall initiate corrective action within no more than eight hours of the initial observation,* ***or within no more than 24 hours of the initial observation if limited remaining daylight hours prevent faster action.***

Comment 7.10

Comment regarding the specific draft OCS air permit condition below:

IX.A.1: "The Permittee shall comply with the following for each of the permanent diesel generator engines on the OSSs during O&M. Each permanent diesel generator engine shall: [40 C.F.R. § 52.21, 40 C.F.R. § 55.6(a)(4)] a. Have a maximum engine power of less than or equal to 500 kW. b. Each engine shall be equipped with a non-resettable hour meter. c. Each engine shall not exceed 500 hours of operation on a 12-month rolling total basis."

Atlantic Shores proposes that this condition include language such that diesel generator engines larger than 500 kW could be used if the total emissions associated with all permanent diesel generator engines is the same or lower than using the number of 500 kW engines included in the application PDE. Similar language has been applied to vessel engine emission standards in the OCS Air Permits of Coastal Virginia Offshore Wind, Sunrise Wind, Revolution Wind, Vineyard Wind I, South Fork Wind, and New England Wind I.

Response 7.10

The permit condition identified by this commenter refers to the permanent diesel generators engines (up to a maximum of eight) to be located on the offshore substations during the O&M phase. Atlantic Shores stated in its application that these generators would be 500 kW or less, and the application was evaluated on that basis. In addition to the condition identified by the commenter, these engines are also subject to other permit conditions such as Section IV.B of the permit's NSPS IIII requirements, BACT and LAER emission limits, and New Jersey particle emission standard requirements under N.J.A.C. 7:27-4.2, which contain per-hour emission limits. These requirements apply to each specific engine (or stack) individually, not the sum of the emissions across all the engines. And, the size (in kW) of the actual engines chosen impacts the regulatory requirements and emission standards applicable to these engines. If larger engines need to be installed, the proper procedure is to request a permit modification.

The commenter fails to identify any condition in an OCS air permit for another wind farm that is similar to the condition it proposes.

Comment 7.11
Commenter provides the below miscellaneous editorial notes on the draft OCS air permit:

a) Please edit the signature page to read "construct and operate *two* offshore wind farm project*s* located on the OCS…"

b) Please edit the Project Description to read "proposes to construct (install) and operate *two offshore wind farm projects totaling* approximately *2,840* megawatt ("MW") in the designated Renewable Energy Lease Area OCS-A 0499."

c) In Condition IV.A.1.B, "OCS major repair" should read "OSS major repair."

d) In Condition IV.A.5., the letters denoting individual conditions are nonsequential.

e) Please edit Condition IV.B.2.e. to read "If an event requires the removal of a switchgear, the *damaged* major components will be replaced with new components *or repaired in accordance with OEM recommended procedures*.

f) In Condition IV.H.1.b.1, the correct Program Interest number is PI 5583*4*.

g) In Condition IV.I, the numbers denoting individual conditions are nonsequential.

Response 7.11
a) EPA notes that although this permit is being issued for two offshore wind farms, a single permit application was submitted for both and they are treated as a single OCS source (the OCS Facility) for purposes of this permit. EPA is revising the language referenced to read as follows:

> *Atlantic Shores Offshore Wind Project 1, LLC is hereby authorized to construct and operate ~~the~~* ***two*** *offshore wind farm***s** *~~project~~ located on the OCS within the lease area OCS-A 0499, about 7.6 nautical miles (8.7 statute miles) from the New Jersey shoreline. The construction and operation of the* ***two*** *wind farm***s** *shall be subject to the attached permit conditions and permit limitations.*

b) EPA has no objection to clarifying that this permit covers a single OCS source (the OCS Facility) consisting of two wind farms, or clarifying the total MWs of the two wind farms. We note that page 336 of Atlantic Shores' June 26, 2024, OCS application states that Project 1's capacity is 1,510 MW and Project 2's new target capacity is 1,327 MW, which provides a total target capacity of 2,837 MW. This change does not affect any of the existing terms and conditions of the OCS air permit because the modeling and other analyses in the application already take into account the emissions associated with constructing and operating turbines totaling 2,837 MW capacity.

Therefore, within the Project Description, EPA is revising the following two sentences as follows:

> *Atlantic Shores Offshore Wind Project 1, LLC ("Atlantic Shores" or "Permittee"), along with its affiliate, Atlantic Shores Offshore Wind Project 2, LLC ("Atlantic Shores Project 2 Company"), proposes to construct (install) and operate* ***two offshore wind farms*** *~~projects~~* ***totaling*** *~~an~~ approximately* ***2,840*** *~~2,470~~ megawatts ("MW") ~~offshore wind farms project~~ in the designated Renewable Energy Lease Area OCS-A 0499 awarded by BOEM.*
>
> *Atlantic Shores and its affiliate, Atlantic Shores Project 2 Company, propose to develop the OCS lease area into two wind farms, known as Atlantic Shores Project 1 ("ASP1") (1,510 MW) and Atlantic Shores Project 2 ("ASP2") (****target capacity of 1,327*** *~~960~~ MW), collectively referred to as the OCS Facility.*

c) EPA is correcting this typographical error.
d) EPA is correcting this typographical error.

e) EPA assumes the comment refers to Condition IV.D.2.e. EPA agrees with the proposed revisions to clarify that Condition IV.D.2.e. allows for the possibility of repairing the damaged switchgear component, if it can be done in accordance with the original equipment manufacturer's recommended procedures. In addition, EPA is further revising this condition as a result of Comment 1.3.

Condition IV.D.2.e. is revised as follows:

> *If an event requires the removal of a switchgear, the ~~affected~~* ***damaged*** *major components will be replaced with new components* ***or repaired in accordance with the original equipment manufacturer's recommended procedures.*** *For purposes of this requirement, an event means when any component of a switchgear is damaged and results in SF_6 leakage that cannot be repaired on site.* ***The Permittee shall consider the technical and economic viability of installing SF_6-free switchgears whenever an SF_6-containing switchgear needs to be replaced with a new one and install the SF_6-free switchgear, if deemed technically feasible. The Permittee shall keep a record of this decision and its basis for each replaced switchgear.***

f) EPA is correcting this typographical error.
g) EPA is correcting this typographical error.

Comment 7.12
Clarifications to the Fact Sheet

Page 15 of 67: Per above, we note that the SO_2 emissions do not contribute meaningfully to modeled AQRV impacts.

Response 7.12
The US FWS provided the following response to the comment above:

> *The U.S. Fish & Wildlife Service (FWS) does not support increasing sulfur emission limits to the Prevention of Significant Deterioration (PSD) trigger level for the Atlantic Shores – South, Wind Energy air quality permit.*
>
> *Utilizing federal FLAG 2010 guidance, FWS routinely asks that all impairing emission increases be included during air quality PSD permit review. This ensures that all potential impacts to Class I areas are evaluated together. Each pollution species has a unique influence on Air Quality Related Values (AQRV) yet combines to produce a comprehensive impact to the Wilderness.*
>
> *Increases to SO_2 emissions affect visibility in both the near- and far-field and varies considerably during the life of the project. Sulfur deposition also contributes to acidification of soils, coastal marsh, and requires additional evaluation.*
>
> *The revised visibility tables included with the comment letter are insufficient to inform our review. The FWS would consider the request to increase SO_2 emissions to 40 tons per year a significant change to the application requiring renotification.*

Section 8.0 – Decommissioning Issues

Comment 8.1
These wind farm projects are unsustainable, unreliable, destructive and unaffordable with no decommissioning plan in place.

Response 8.1
The current OCS air permit does not authorize any decommissioning/dismantling of the project. Decommissioning activities, which differ substantially from construction and operation activities, are addressed through a process separate from the lease issuance process under the Department of Interior's regulations. *See* 30 C.F.R. Part 585, Subpart E ("Lease and Grant Administration") and Part 285, Subpart I ("Decommissioning"). The decommissioning plan will be developed and implemented at the end of the operational life of the project, which has an expected 30-year life span, at which time regulatory requirements may have changed and/or new technologies and equipment may be available. Potential air emissions will then be assessed and the applicability of regulatory requirements in effect at that time will be determined, including the requirements of any needed OCS air permit. Also *see* Response 8.3 regarding the current Conceptual Decommissioning Plan in BOEM's ROD.

Comment 8.2
Just one of the environmentally degrading and irreversible effects of the Atlantic Shores Offshore Wind Projects entails the fact that there is an entirely insufficient decommissioning plan, which will encourage debris, refuse, and immovable towers, never to be removed from the pristine ocean floor. As such, future generations will be left with the vast and inestimable cost of dealing with the impossible cleanup efforts. Our environment, recreational and commercial

fishing industry, and our precious ocean would never recover from these entirely unnecessary and outrageous actions.

Response 8.2
No specific analysis was identified or submitted to substantiate the statements made in the comment. For additional information on the timing of the decommissioning plan, *see* Response 8.1. The current Conceptual Decommissioning Plan is also discussed in page 86 of 560 of BOEM’s FEIS, *see* Response 8.3. *See* Response 4.4 for a link to the FEIS.

Comment 8.3
The Industrial Offshore Wind Project fails to include any ongoing funding for the ultimate removal/decommissioning and/or replacement of the turbines, which means at the end of their useful life the companies could decline to remove them and either go out of business or file for bankruptcy. The State's residents, therefore, will likely be forced to either live with over 200 decaying Eiffel Towers in their ocean off their Shore or pay the costs associated with removing them.

Response 8.3
This comment is outside the scope of this OCS air permitting action under the Clean Air Act. However, the Conceptual Decommissioning Plan in page 86 of 560 of BOEM’s FEIS states:

> *If the COP[Construction and Operations Plan] is approved or approved with modifications, Atlantic Shores would have to submit financial assurance (e.g., a bond) prior to installation that would be held by the U.S. government to cover the cost of decommissioning the entire facility in the event that Atlantic Shores would not be able to decommission the facility, as outlined under 30 CFR Part 585 Subpart E.*

See Response 4.4 for a link to the FEIS.

Comment 8.4
Commenter asks what the long-term plan for the turbines is if the project comes to fruition when they are at the end of their lifespan. Will they just be another man-made thing polluting the ocean?

Response 8.4
At the end of the project’s operational lifespan, anticipated to be 30 years, there will be a decommissioning phase to remove structures from the Outer Continental Shelf (OCS). As best available control technologies are expected to change throughout the lifespan of the project, the current OCS permit does not authorize actions for the decommissioning phase. *See* Response 8.1 for additional discussion.

Comment 8.5
Most proposed offshore wind projects are structured as limited liability single purpose entities, with the only assets of the company being the turbines, undersea cables, and related equipment. If the company decides to discontinue the project, the company can simply declare bankruptcy with the burden of the costs of decommissioning the turbines falling on the taxpayers and the

electricity consumers.

Response 8.5
This comment falls outside the scope of this permitting action, *see* Response 8.3.

Comment 8.6
During decommissioning, equipment and vessels will be needed to deconstruct and transport project components and return the offshore lease area to its preexisting state. This will involve discharging air pollutants, as well as disposing of the spent air pollutants used in the turbines and associated infrastructure. However, the only reference the draft permit makes to decommissioning is that it “does not authorize the permittee to commence any such decommissioning activities, which may be subject to a separate preconstruction review process.” The use of ‘may’ is troubling, because a preconstruction review process will certainly be required to analyze the environmental impacts of decommissioning activities.

The draft air permit should include a contingency plan in the event that decommissioning activities will use currently available technology. Of course, if emissions control technologies for marine vessels do improve, Atlantic Shores should be required to implement them, so the contingency plan should only become effective if there are no better (i.e., less environmentally impactful) technologies available.

The proposed approach to decommissioning does not make logical sense when the same requirements would be applicable to Projects 1 and 2 for construction as well as operations and maintenance, both of which could take multiple years—three decades, in the case of operations and maintenance. In order to properly allow for technological development, the permit must be reevaluated every five years, like New Jersey’s operating certificates and general permits are.

Response 8.6
EPA is issuing an OCS air permit to Atlantic Shores to construct and operate the OCS source described in the submitted permit application. This application does not describe proposed decommissioning activities in sufficient detail for EPA to establish appropriate terms and conditions applicable during the decommissioning phase. This is to be expected given a detailed decommissioning plan typically is not developed until close to the end of the project life. Moreover, offshore vessel technology is currently changing and is expected to continue to change into the future. It would not be appropriate for EPA to issue an OCS air permit containing terms and conditions applicable to unspecified decommissioning activities that may not occur for thirty years. Upon receipt from the permittee of all information pertaining to decommissioning activities necessary for EPA to determine the applicable CAA requirements, EPA will evaluate the proposed activities and determine whether a new or revised OCS air permit is required to authorize such activities.

To the extent the commenter seeks regular review of the permit covering the C&C and O&M phases of this project, the OCS air permit already incorporates onshore Clean Air Act and state/local requirements that are incorporated by reference into 40 C.F.R. Part 55 and are thus applicable to this project. Under the New Source Review program, PSD and NNSR permits are issued prior to construction and are not reevaluated on a periodic basis. However, although the applicant is not applying for a Clean Air Act Title V (operating) permit at this time, it is required to submit an initial Title V operating permit application within twelve months of the new facility's commencement of operations. The applicant must apply to renew the operating permit every 5 years.

Comment 8.7
Commenter states that there are no plans for maintaining and dismantling these horrific monsters.

Response 8.7
With respect to maintenance, EPA has reviewed the applicant's plans to conduct maintenance of the wind farm infrastructure and its associated maximum air emissions for compliance with Clean Air Act requirements. The OCS air permit contains many requirements applicable during the project's O&M phase which apply to maintenance of the wind farm. These permit requirements include provisions such as emission limits and other requirements applicable to the specific OCS source vessels that would be used to conduct maintenance, as well as maximum daily and annual emissions limits for the OCS Facility as a whole during the O&M phase.

With respect to dismantling, as discussed in the Fact Sheet that accompanied the OCS Draft Permit, the dismantling of the wind farm may require a new OCS air permit around the end of the project's lifespan, which is projected to be around 30 years. *See* Response 8.3 for additional discussion of decommissioning.

Section 9.0 – Project Segmentation

Comment 9.1
Atlantic Shores South is currently seeking a segregation of Lease Area OSC-A 0499 so that Project 1, LLC and Project 2, LLC will own their own separate leases for their respective projects. According to Atlantic Shores, "At a later date, when necessary, Project Company 1 and Project Company 2 will undertake any necessary permit transfers, amendments, and/or application requests to ensure that Project Company 2 is subject to all required terms and conditions under the CAA to conduct the activities approved in its respective COP for its new commercial lease area". For now, according to EPA, "Project Company 1 is the appropriate new owner given that its Project is the first one to be developed in Lease Area OCS-A 0499, with Project 2 anticipated to occur thereafter in a staggered manner."

Commenter questions the need and purpose for such segmentation and the resulting delegation of responsibilities under the air permit, especially since the Assignment and Assumption Agreement between Atlantic Shores Offshore Wind, LLC; Atlantic Shores Project 1, LLC; and Atlantic Shores Project 2, LLC was not included in the docket with the letter requesting a change in ownership.

Response 9.1
In its letter requesting that Atlantic Shores Project 1, LLC take over the OCS air permit application (Ownership Transfer Request Letter), Atlantic Shores Offshore Wind LLC explained that Atlantic Shores and its Project Companies have requested from Bureau of Ocean Energy

Management a lease segregation whereby Atlantic Shores Offshore Wind Project 1, LLC (Project Company 1) will retain a portion of Lease OCS-A 0499 and Atlantic Shores Offshore Wind Project 2, LLC (Project Company 2) will acquire a new lease consisting of the remaining portion of Lease OCS-A 0499. The letter was accompanied by an Assignment and Assumption Agreement between Atlantic Shores Offshore Wind, LLC, Project Company 1, and Project Company 2, which has now been added to the docket for this action in Regulations.gov. In light of the pending lease segregation and prior designation of the Project Companies as the leaseholders, Atlantic Shores Offshore Wind LLC requested a transfer of ownership of the OCS air permit it was seeking for this project to Project Company 1. EPA notes that the quote the commenter attributes to EPA was taken from the Ownership Transfer Request Letter.

Atlantic Shores stated in its letter that at a later date, when necessary, Project Company 1 and Project Company 2 will undertake any necessary permit transfers, amendments, and/or application requests to ensure that Project Company 2 is subject to all required terms and conditions under the CAA to conduct the activities approved in its respective Construction and Operations Plan (COP) for its new commercial lease area. Atlantic Shores has also stated that Atlantic Shores and the Project Companies will ensure that BOEM's current decision-making process is coordinated with this request in terms of timing and reference to this change in ownership is included in any applicable decision documents.

Such a division of the project covered by this permit into two separate permits is not before the EPA at this time. If Atlantic Shores completes its lease segregation with BOEM and submits to the EPA an OCS air permit application or applications to divide the permit between Project 1 and Project 2, the details of the segmentation and any resulting delegation of responsibilities under the OCS air permit raised by the commenter would be considered and addressed as part of that future permitting action.

Section 10.0 – Miscellaneous Issues

Comment 10.1
Alternative Sites, Sizes and Processes.

The application states in Section 3.9.3 that per New Jersey Annotated Code 7.27–18.3(c)2 an analysis of alternative sites within New Jersey and of alternative sizes, production processes, including pollution prevention measures, and environmental control techniques, demonstrating that the benefits of the newly constructed, reconstructed or modified equipment significantly outweigh the environmental and social costs imposed as a result of the location, construction reconstruction, or modification and operation of such equipment.

Notwithstanding the discussion following that paragraph no such alternative analysis for the proposed project has been conducted.

The process by which the New Jersey wind energy area was identified did not include any analysis of alternative sites or energy production options within New Jersey. It only considered limited offshore renewable energy areas that were circumscribed by the charge to the NJ Renewable Energy Task Force that conducted the site area selection process.

The process of awarding subsidies to the wind energy projects by the NJ Board of Public utilities under the Offshore Wind Economic Development Act at no point considered alternative energy sources within New Jersey.

Finally, at no point in the BOEM National Environmental Policy Act review process has analysis of alternative energy sites or energy production processes within NJ been included in any environmental assessments or impact statements, nor for that matter any alternative offshore areas other than the Task Force selected area.

Therefore, this section of the New Jersey Code has not been complied with.

Response 10.1
The applicant fulfilled its N.J.A.C. 7:27-18.3(c)(2) requirement to conduct an alternative site analysis in Section 3.9.3 of the revised application. The size and scope of this type of wind farm project can only be approved and constructed on federally approved lease areas in the ocean through a Wind Energy Commercial Leasing Process which is managed by the Department of Interior's Bureau of Ocean Energy Management. BOEM is responsible for implementing the federal regulations developed for the Outer Continental Shelf Renewable Energy Program. These regulations provide a framework for issuing leases, easements and rights-of-way for OCS activities that support production and transmission of renewable energy, including offshore wind, ocean wave energy, and ocean current energy. BOEM has gone through an extensive consideration of offshore sites before issuing its offshore wind development leases. And, BOEM has issued an FEIS for the Atlantic Shores Project that considered 21 project alternatives at this specific lease site. The commenter's request that the applicant provide an additional analysis of alternative sites or energy production processes within onshore New Jersey cannot be conducted as envisioned by the commenter, since construction of this type of project, with its proposed size and scope, is not technically and regulatorily feasible within the land occupied by the state of New Jersey. Alternatively, the commenter may be arguing that an alternative site analysis could have been performed within a different BOEM lease area in the ocean. However, those leases area are all already leased to other entities and a separate review will eventually be conducted for each project site.

See also Response 4.48 regarding BOEM's consideration of 21 alternatives to this project in the Final Environmental Impact Statement (FEIS) and its conclusion in the ROD.

Comment 10.2
Measurement and Enforcement
40 CFR § 55.9 Enforcement states that Outer Continental Shelf (OCS) sources must comply with all requirements of 40 CFR Part 55 and all permits issued under it. Failure to do so is considered a violation of section 111(e) of the Act. All enforcement provisions of the Clean Air Act (CAA), including sections 113, 114, 120, 303, and 304, also apply to OCS sources and permittees.

Given the importance and uniqueness of the Brigantine National Wilderness Area (BWA), any air permit should include requirements for measurements of air pollutant concentrations at the BWA coincident with periods of offshore wind project construction. It should also have provisions to order cessation of construction activities should those measurements exceed predicted concentrations.

Response 10.2
It should be noted that EPA maintains its enforcement authorities under the Clean Air Act regardless of whether they are listed in the permit.

EPA does not see a need to include additional ambient monitors at the Brigantine National Wilderness Area (BWA) beyond those that are already in place. First, there are a number of air monitors already present in the area of the BWA. Current monitors at the Brigantine National Wilderness Area include the Interagency Monitoring of PROtected Visual Environments (IMPROVE) program monitor, which monitors visibility, and the National Atmospheric Deposition Program (NADP) program monitor, which monitors the wet deposition of sulfur, nitrogen, and mercury. The New Jersey State Department of Environmental Protection also operates a site which monitors ozone (O_3), SO_2, and $PM_{2.5}$ concentrations.

Second, at such a distance from the wind farm lease area, we could not determine which portion of the concentration detected by any ambient air monitor at the BWA came from the project. Even if accurate meteorological data from the relevant time was available, it would be extremely difficult to attribute monitored values at the BWA to the construction activities of the project with reliable accuracy. Other sources of pollution, such as vessels unrelated to the project or onshore combustion sources, could be located upwind of the BWA and contributing to any measured exceedance. There would also be a time lag between a monitored value and any evaluation, however inaccurate, that could be conducted to try to determine sources contributing to that value.

However, the permit contains measures to ensure protection of the Brigantine National Wilderness Area, including through measures such as maximum daily emission limits developed based on air quality analyses, and monitoring measures to ensure compliance with these limits, among many others. Construction emissions from all sources and for all activities were modeled continuously (24 hours per day and 365 days per year, for 8760 hours per year or 8784 hours per year in a leap year) using meteorological data for the 3-year period between 2018-2020. To model compliance with short-term NAAQS and increment, the emission sources were placed in the northwest corner of the lease area, closest to the coastline of New Jersey and the BWA, where they were modeled continuously for 3 years; modeling for compliance with annual NAAQS and increment placed a worst-case number of WTGs and OSSs to be constructed in one year in their actual expected locations, and chose WTG locations closest to shore. This was meant to capture all meteorological conditions to ensure the highest impacts were modeled and the standards were protected. *See* Responses 5.1, 5.2, 5.8, 5.12, and 5.13 for further discussions of modeling analyses conducted to demonstrate compliance with the NAAQS and PSD increment standards. The air quality analyses demonstrated that emissions in either phase (C&C or O&M) will not cause or contribute to any violations of the NAAQS or PSD Class I Increment at the BWA.

Comment 10.3
Liability

The Atlantic Shores projects 1 and 2 have taken ownership of the air permit from its corporate sponsors, EDF Renewables and Shell New Energy. It is not clear that the project itself has sufficient financial resources or backing to pay for the environmental damages that might occur at the Brigantine National Wilderness Area (BWA) from its activities. It should be stated whether the Atlantic Shores projects themselves have such resources, or liability coverage in the form of insurance policies, surety bonds, letters of credit or other mechanisms.

This should be confirmed before any permit approval, and provisions for that included in any permit.

Response 10.3
This comment is outside the scope of this OCS air permitting action under the Clean Air Act. For the wind farm's impacts on the Brigantine National Wilderness Area, *see* comments in Sections 5.0 and 6.0. For issues related to setting aside funding for decommissioning purposes, *see* Response 8.3.

Comment 10.4
Notice of Intent.

According to 40 CFR § 55.4, a Notice of Intent (NOI) must be submitted to the United States Environmental Protection Agency (EPA) Regional Office for new or modified Outer Continental Shelf (OCS) sources. The NOI must also be sent to the air pollution control agencies of the Nearest Onshore Area (NOA) and any onshore areas next to the NOA. 40 CFR 55.4 only applies to sources located within 25 miles of a state's seaward boundaries.

It is not clear whether such notice was provided for the segmented project of this application.

It is also not clear why the application, once it was deemed complete on 8/21/2023 was not opened for public comment as required.

These should be explained.

Response 10.4
On December 22, 2021, EPA Region 2 received a Notice of Intent (NOI) for the Atlantic Shores project covered by today's permit. A copy of the NOI was also sent to the air pollution control agencies of the Nearest Onshore Area (NOA) and onshore areas adjacent to the NOA: New Jersey, New York, Pennsylvania, and Delaware. Please see item No. 3.1 of the docket at https://www.regulations.gov/docket/EPA-R02-OAR-2024-0312/document.

An NOI is only required for OCS sources located within 25 nm from states' seaward boundaries, prior to performing any physical change or change in the method of operation that results in an increase in emissions. *See* 40 C.F.R. § 55.4. The project covered by this permit – the construction of two wind farms on Renewable Energy Lease Area OCS-A 0499 – has not been segmented at this time. As of now, the OCS permit has only undergone a transfer of ownership. An NOI was not required for a transfer of ownership since it did not meet any of the criteria required for the submission of an NOI; the transfer of ownership did not involve a physical change or change in method of operation, and the ownership change did not result in an increase in emissions. An NOI will be required for a request to segment the project if the request meets the criteria for submitting an NOI.

Under 40 C.F.R. § 124.10, the Regional Administrator, the State director or the Tribal director as the context requires, or an authorized representative, shall give public notice that certain listed actions have occurred. One of those listed actions is that a draft permit has been prepared under 40 C.F.R. § 124.6(d). Finding a submitted permit application complete is not one of the listed actions, and EPA is not aware of any other regulatory requirement for a public comment period when an application is deemed complete. For a copy of 40 C.F.R. § 124.10, *see* https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-124/subpart-A/section-124.10.

The draft permit and required fact sheet were prepared and available for review on July 12, 2024. The public comment period started on July 12, 2024, and ran until August 16, 2024, with a virtual public hearing held on August 12, 2024.

Comment 10.5
Coastal Zone Management Act Consistency

The federal Coastal Zone Management Act (CZMA) was enacted by the United States Congress in 1972 (16 §§U.S. Code 1451-1464) and is intended to protect coastal resources with an established goal to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone."

The conclusions reached in Appendix F regarding consistency of the project with the State's CZMA rules rely in many cases only on certain biased sources of information and are flawed. There are numerous provisions of the State's CZMA rules that are violated by this project. Some examples are provided below.

This project starting 9 miles offshore, with 1046 foot high turbines, closer than any other modern project in the entire world, clearly cannot comply with the visual resource protection provisions of Section 7.7-1.1(e)-1.i of the NJ CZMA rules. This is confirmed by simple geometry, and by the renditions in the EIS and the COP, which even depicting fewer turbines than will actually be seen, show that they are clearly visible from the shore even under overcast conditions.

The attempts by the agencies to dismiss this based on what was called the Rutgers Meteorological study are disingenuous. That study was of an undefined smaller object on land mostly around the Atlantic City airport. Meetings with Rutgers staff confirmed that those frequencies of visibility have nothing to do with the viewing of a 1046-foot high wind turbine off the open ocean.

The project clearly cannot comply with the 200 tourism job loss criteria of CZMA rule Section 7.7-15.4(c). Based on several public response survey studies, including the University of Delaware study sponsored by the BOEM, the tourism job losses will be in the thousands. Similarly, the project cannot comply with the net job gain criteria in any given year. The job gain from the project in the operational years will be less than 100 whereas the tourism jobs are in the thousands and will persist.

There are many other examples where the project cannot reasonably comply with the NJ CZMA criteria, those will be provided in another forum.

Response 10.5
As discussed in the Fact Sheet that accompanied the draft permit for this project, Atlantic Shores prepared a Consistency Certification to demonstrate that the proposed project located within BOEM Lease Area OCS-A 0499 is consistent with the policies identified as enforceable by N.J.A.C. 7:7, and most recently submitted to BOEM an updated certification of consistency with the New Jersey Coastal Management Program in May 2024. And, NJDEP has determined that the proposed activity will be conducted in a manner consistent with New Jersey's Coastal Zone Management Plan and pursuant to 15 C.F.R. Part 930, which authorizes states with approved Coastal Zone Management programs to conduct a coastal zone consistency review and concurrence determination of projects within or outside the state coastal zone boundary. *See* the Fact Sheet for additional discussion.

See Response 4.25 and 4.51 for concerns about visibility. *See* Response 4.39 for concerns about tourism.

Comment 10.6
Commenter provides a notice of its intent to sue the EPA and Atlantic Shores Offshore Wind LLC pursuant to 42 U.S.C. § 7604(a)(1) of the Clean Air Act. The commenter states that this Notice of Intent to Sue and its attachment provide the requisite information stipulated by 40 C.F.R. 54.3(b). When EPA approves Atlantic Shores' Clean Air Act permit, OCS-EPA-R2 NJ 02, such approval will be arbitrary and capricious because Atlantic Shores pile driving related emissions will contravene the Class I Area $PM_{2.5}$ 24-hour standard for the Brigantine Wilderness Area in NJ.

Response 10.6
For discussion regarding this project's impacts on the Class I Area $PM_{2.5}$ 24-hour standard for the Brigantine National Wilderness Area and other discussion regarding the air quality and the Class I area, *see* Sections 5.0 and 6.0.

Regarding challenges to a final permit, EPA's final permit decision may be appealed administratively within 30 days of service of notice of the final determination. The procedures for administrative review are provided at 40 C.F.R. § 124.19 ("Appeal of RCRA, UIC, NPDES and PSD Permits"). Judicial review of a final permit action is available in the United States Court of Appeals within 60 days from the date on which this final permit action appears in the Federal Register. A petition for administrative review is a prerequisite to seeking judicial review of a final permitting action. For more information *see* 40 C.F.R. Part 124, a copy of which is available at https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-124. Submitting a "60-day Notice of Intent to Sue" is not a prerequisite to judicial review of a permit issued pursuant to 40 C.F.R. Part 124.

Comment 10.7
I respectfully request that EPA consider the lack of adequate notice posed by the incomplete Project application submitted by Atlantic Shores, resulting loss of due process, inadequate mitigation in the PEIS [Programmatic Environmental Impact Statement] as written, and other violations of NEPA, 40 CFR Part 55 and EPA's own policies and procedures, and take all action necessary to prevent any adverse outcomes. A No Action Decision is requested.

Response 10.7
EPA found the Atlantic Shores project OCS air permit application complete on August 21, 2023. Additional information was provided to the EPA following that date to supplement the application, and EPA reviewed that information in its development of the draft permit. The final permit application and other supplemental materials were provided in the docket for the draft permit on Regulations.gov (docket number EPA-R02-OAR-2024-0312) for the public to review when the public comment period for the draft permit opened on July 12, 2024.

In a BOEM memorandum entitled "Compliance Review of the Construction and Operations Plan for the Atlantic Shores Offshore Wind South Projects for Commercial Lease OCS-A 0499" that is attached to the ROD and available on page 173 of 208 of the ROD, BOEM states:

> *BOEM conducted its analysis under the National Environmental Policy Act (NEPA) in its final EIS to assess the reasonably foreseeable impacts on the physical, biological, socioeconomic, and cultural resources that could result from the construction and installation (construction), operation and maintenance (operations), and conceptual decommissioning (decommissioning) of the Project.*

See Response 4.1 for a link to the ROD. Issuance of OCS Air Permits requires compliance with 40 C.F.R. Part 55. As no specific grievances were stated regarding NEPA, 40 C.F.R. Part 55, or EPA policy and procedures, EPA cannot specifically respond to the comment.

Finally, as a clarification, the Atlantic Shores project is subject to an Environmental Impact Statement under NEPA. The PEIS mentioned by the commenter refers to the New York Bight PEIS, a draft of which was issued by BOEM on Jan. 8, 2024, following the execution of the six NY Bight leases. The final PEIS will be completed prior to COP submissions for the six covered leases, and will describes the potential environmental and social impacts resulting from development of the six New York Bight leases.

Comment 10.8
Each large offshore substation (OSS) can use up to 20,000 gallons of diesel fuel, 185,000 gallons of mineral oil, 400 gallons of sulfuric acid (batteries), 3,050 gallons of water/ethylene glycol, 54 gallons of AFFF-Firefighters aid, 794 pounds of refrigerant, 15 gallons of lubricant.

Response 10.8
The use of mineral oil, sulfuric acid in batteries, water, ethylene glycol, AFFF-Firefighters aid, refrigerant, and lubricant is not expected to result in significant air emissions, and thus is outside the scope of this permitting action under the CAA and does not require a response from EPA. VOC emission losses from the ultra-low sulfur diesel storage tanks are regulated by this OCS permit, *see* Response 10.21. *See* Response 4.2 for comments on OSS fuel use.

Comment 10.9
The presence of these towering structures according to EPA's and Atlantic Shores' own documents have increasing potential for dangerous air emissions and further highlights the potential for substantial adverse effects on air quality. Air pollutant emissions include, according to the EPA's Draft Permit for the Project: nitrogen oxides, carbon dioxide, volatile organic

compounds [aka VOCs, or forever chemicals], total suspended particles, particulate matter, with an aerodynamic diameter less than or equal to 10 micron, particulate matter with an aerodynamic diameter less than or equal to 2.5 microns, sulfur dioxide, greenhouse gas, HAPs (hazardous air pollutants), Sulfur hexafluoride (SF_6), Ultra Low Sulfur Diesel ("ULSD") storage tanks "which will emit fugitive VOC emissions" and other activities which will do the same. And based on its potential to emit air pollution, the Atlantic Shores Project is subject to the CAA's Prevention of Significant Determination ("PSD") and Non-Attainment New Source Review requirements, federal standards that apply to diesel engine, and several New Jersey State air regulations, because the Project has "the potential to **emit over 250 tons per year of any regulated NSR pollutant during both C&C and O&M**." *(Emphasis added by the commenter.)*

Response 10.9
40 C.F.R. § 55.1 states that, "Section 328(a)(1) of the Clean Air Act ("the Act"), requires the Environmental Protection Agency ("EPA") to establish requirements to control air pollution from outer continental shelf ("OCS") sources in order to attain and maintain Federal and State ambient air quality standards and to comply with the provisions of part C of title I of the Act." The OCS permit's requirements are intended to ensure that air emissions from this project's C&C and O&M phases are controlled in accordance with the Clean Air Act. The fact that this project will emit more than 250 tons per year of any regulated NSR pollutant means that PSD and NNSR requirements apply to the project, and thus the permit contains BACT and LAER, among other requirements, to control air emissions under these regulatory programs. *See* Response 5.22 for further discussion of PSD program requirements. In addition, air quality modeling analyses were conducted for the worst-case emissions possible under the terms and conditions of the OCS permit during both the C&C and O&M phase to ensure that the project would not cause or contribute to a violation of the NAAQS and PSD increment. For further discussion on this, *see* Section 5.0. EPA is issuing this final permit based on its conclusion that the project meets the applicable PSD and NNSR requirements.

The purpose of the PSD regulations under the CAA is to protect public health and welfare, preserve, protect, and enhance the air quality in national parks, national wilderness areas, and other similar areas, ensure economic growth occurs in a manner consistent with the preservation of existing clean air resources, and ensure that any decision to permit projects that increased air pollution is made only after careful evaluation of all the consequences of such a decision and after adequate procedural opportunities for informed public participation in the decision making process.

Comment 10.10
Commenter urges the EPA to conduct a thorough and comprehensive review of the proposed wind turbines' impact on aviation safety and community welfare. It is crucial that all potential risks are meticulously assessed, and that the safety, health, air quality and well-being of the community and local residents are prioritized.

The EPA's Public Notice contemplates no reports except for once a year to assess the impact of the proposed wind turbine project by Atlantic Shores on air emissions. Considering the grotesque potential for particulate matter and dangerous SF_6 emissions by the lubricants involved in the construction and operation of the turbines, why aren't more reports required by Atlantic Shores? There is no contract, so any "promise" by Atlantic Shores rings hollow.

Response 10.10
Aviation issues are outside the scope of this permitting action under the Clean Air Act. However, we note that Section 3 of BOEM's Record of Decision outlines Navigational and Aviation Safety Conditions. Every wind turbine generator, offshore substation, and met tower will be clearly marked and each wind turbine generator will be lighted conforming to Federal Aviation Administration (FAA) standards.

Although the compliance data will be collected and calculations made by the Permittee on a daily or monthly basis, the EPA considers annual reporting for this type of project to be adequate. This project relies mostly on the use of regular marine vessels, engines, and switchgears, which are types of equipment that are not prone to significant air emission upsets that would require a more robust reporting requirement. For other concerns regarding SF_6 emissions, please *see* the responses in Section 1.0 of this document.

Comment 10.11
As a New Jersey homeowner, stakeholder, and concerned citizen, I am writing to respectfully request that the EPA also consider BOEM's other wind turbine leases in the vicinity of this Project. For example, there is a New York Bight Draft Programmatic Environmental Impact Statement ("PEIS") for the proposed project comprising six NY Bight lease areas ("the Project") offshore New Jersey and New York.

Response 10.11
Under the National Environmental Policy Act, BOEM went through a process to develop a Final Environmental Impact Statement for this project. *See* Response 4.4 for a link to BOEM's FEIS. Development of a programmatic environmental impact statement for this project is outside the scope of this OCS air permitting action under the Clean Air Act. *See* Response 5.18 for a discussion of cumulative impact reviews under PSD air quality analyses, and *see* Response 10.7 for a discussion on the New York Bight PEIS.

Comment 10.12
Right now, wind turbines emit bisphenol A (BPAs) and micro plastic in their blades. One of the biggest risks in pollution today is from these kinds of materials. Yes, there is research going on to find ways to control that. There is also research going on to find ways to more effectively recycle these turbines when they are done by using different materials, but the problem is, we are proceeding at breakneck speed before we have good solutions to many of the problems that this project and others like it are creating.

Response 10.12
Although the commenter raises general concerns about bisphenol A and micro plastic air emissions, it does not do so with adequate specificity to allow EPA to evaluate whether emissions of these substances, if any, and any potential impacts from such emissions, are at a level regulated by the Clean Air Act or state/local regulations incorporated by reference into 40 C.F.R. Part 55.

Disposal of the project's physical components after decommissioning is outside the scope of this OCS air permit under the Clean Air Act.

Comment 10.13
Incredulously, the Fact Sheet on p. 36, discusses Atlantic Shores eliminating cap and trade to mitigate the air polluting effects, for application expediency. "The application also eliminated carbon capture and storage, a GHG control option involving capturing and storing CO_2 emissions contained in engine exhaust, as technically infeasible for engines located onboard marine vessels." The Project is already incredibly polluting, yet there is no description of cap and trade for the pollutants located in the OSSs. Notwithstanding that it takes 25 to 37 years to clear emissions, anywhere from the length of the project itself to 25% longer than its duration; this Project is not green, but greenwashing the carbon emissions and greenhouse gasses that will result from C&C and O&M of the wind turbine's renewable energy.

Response 10.13
The fact sheet does not mention cap and trade, which generally refers to a system for controlling air emissions that limits emissions for an area or group of businesses and then establishes an accompanying trading program; cap and trade is not applicable to this permit as a control technology or to offshore wind farms in general. Regarding carbon capture and storage, it is not a technology that is widely used at this time, and it has been only considered technically feasible for a small number of (non-wind-farm) projects in which it can be successfully implemented, where they can meet certain specific technical requirements. As discussed in the Fact Sheet, carbon capture and storage is not technically feasible for the marine vessels that this project requires.

The project is expected to limit New Jersey's dependence on nonrenewable energies which do contribute to greenhouse gas emissions. According to BOEM, this project will have air emissions during the C&C phase, and lower air emissions during the O&M phase, but throughout its projected 30-year lifespan it will generate energy with much fewer emissions compared to other nonrenewable sources of electrical energy. *See* discussion in the ROD and FEIS, links to which are available in Responses 4.1 and 4.4. Also *see* Response 4.3.

Comment 10.14
These Industrial Utility Electric Power Plants contain hundreds of thousands of gallons of fossil fuel petrochemicals (listed below) subject to the North Atlantic corrosive saltwater environment suspended above our Ocean less than 9 miles from our beaches and homes. As we have seen with the closure of the beaches in Nantucket, these Industrial Offshore Wind Turbine Power Plants are machines that can and will fail. It is a matter of fact these will leak and spew fossil fuel petrochemicals into the air and water.

Each Wind Turbine Generator (WTG) Can use up to:
400 gals of diesel fuel
350 gals of hydraulic fluid
150 gals of grease
1,081 gals of gear and bearing lubricant
1,800 gals of synthetic ester oil
4,100 gals of water/ethylene glycol

243 lbs of sulfur hexafluoride

Each SMALL Offshore Substation can use up to:
7,500 gals of diesel fuel
37,000 gals of mineral oil
250 gals of sulfuric acid (batteries)
1,030 gals of water/ethylene glycol
3,500 gals of AFFF Firefighting aid
198 lbs of refrigerant
5 gals of lubricant
3,37 lbs of sulfur hexafluoride

Each LARGE Offshore substation can use up to:
20,000 gals of diesel fuel
185,000 gals of mineral oil
3,050 gals of water/ethylene glycol
5,000 gals of AFFF Firefighting aid
794 lbs refrigerant
15 gals of lubricant
9,480 lbs of sulfur hexafluoride

Each On Shore Substation can use up to:
1,500 gals of diesel fuel
10 gals of motor lubricant
272,500 gals of mineral oil
400 gals of sulfuric acid (batteries)
1,275 gals of water/ethylene glycol
794 lbs of refrigerant
11,023 of sulfur hexafluoride

Response 10.14
Commenter did not provide the source of the numbers presented so EPA was unable to corroborate them. The WTGs and OSSs will temporarily have portable diesel generator engines to be used to provide power during the construction and commissioning (C&C) phase. The permit outlines use of 8 OSS Commissioning Generators and 1 WTG Commissioning Generator during C&C. When the C&C phase is completed, up to 8 permanent diesel generators will be located on and used as backup generators for the OSSs during the O&M phase; these generators will be taken from the 8 OSS Commissioning Generators used during the C&C phase. These generators used during the O&M phase will only be used for storm protection and in a large power grid outage. All emissions from these generators were considered for CAA compliance, and the permit contains various conditions addressing these generators.

See Response 4.2 for more information on the OSS generators.
See Section 1.0 for more information regarding SF_6.
See Response 4.20 for comments regarding the Nantucket project.
See Response 4.41 regarding possible oil spill.

Most of the substances mentioned in this comment are not anticipated to be released to the air, and are thus not addressed by this OCS air permit.

Comment 10.15
The Atlantic Seaboard of the United States is consistently prone to hurricanes, with numerous hurricanes occurring annually. The proposed wind farms are not constructed to withstand a greater force than that of a Category 3 hurricane. In fact, studies have posited that in a Category 2 hurricane, up to 6% of the turbine towers in a wind farm will buckle. The same studies propose that in a Category 3 storm, a potential 46% of the towers will buckle. Category 3, 4 & 5 hurricanes are projected to cause 92% damage to the aforementioned turbines in New Jersey. Current International Electrotechnical Commission guidelines for offshore wind turbines do not address the type of winds seen in Category 3-5 hurricane levels. The high frequency of major storms along the Atlantic Coast are likely to significantly reduce the fatigue life of offshore wind turbine components.

Response 10.15
This comment is outside the scope of EPA's action on Atlantic Shores' OCS air permit application, and the commenter has not identified with specificity the studies referenced generally. However, we note that the design of the WTGs has considered the possible hurricane conditions that New Jersey is subject to. The following excerpt is from page 16 of Appendix B (page 185 of 208) of BOEM's ROD:

> *The engineering design of the WTGs [Wind Turbine Generators] and their ability to sufficiently withstand weather events— which include hurricane-level events—are independently evaluated by a CVA [Certified Verification Agent] when reviewing the FDR [Facility Design Report] and FIR [Fabrication and Installation Report] according to international standards. One of these standards calls for the WTG structure to be able to withstand a 50-year return interval event. An additional standard also includes withstanding 3-second gusts of a 500-year return interval event. WTGs are designed to withstand the oceanographic and meteorological conditions expected in the Lease Area, including hurricane force winds.*

See Response 4.1 for a link to the ROD.

Comment 10.16
Another potentially major concern in a hurricane is the extremely powerful force which turbines are subjected to not only due to increased winds but also from increased tidal pressures from waves. Turbines will also be subjected to increased wave action during the occurrence of other storms; the foremost of which being nor'easters, which occur frequently along New Jersey's coastline. These storms have the potential to degrade the turbines' operative efficiency, structural integrity, and economic viability. The turbines will also require far more frequent and invasive maintenance practices, as the environment that is the Atlantic Ocean is a much more hostile environment than land.

Response 10.16
See Response 10.15 which addresses both oceanographic and meteorological conditions expected in the Lease Area of the project. The applicant's expected air emissions during the O&M phase of the project are addressed in the OCS permit.

Comment 10.17
Offshore wind is obviously intermittent. Wind power can never be completely and consistently efficient, as wind strength rises and falls sporadically. Due to this inconsistency, old fossil fuel plants which may be harmful to the environment must remain functional to provide power in excess on days in which wind strength is not powerful enough to suffice.

Response 10.17
This comment is not under the purview of the Clean Air Act and this OCS air permit. However, we note the electricity generated from this project is expected to contribute towards New Jersey's goal (as outlined in the New Jersey Governor's Executive Order No. 307) of 11 GW of offshore wind generation by 2040. This is part of an effort to diversify New Jersey's energy sources and overall rely less on nonrenewable sources.

Comment 10.18
Offshore wind turbine performance over the last decade in Europe has hugely degraded rapidly over time, particularly for newer and larger turbines. Output has also been shown to tend to decrease as the units age and require ever-growing maintenance budgets. The natural consequence of this is a higher operating cost and reduced economic lifetimes. As costs increase and output declines, the costs of maintaining the project will far surpass expected revenues. The natural human response to this trending downturn in economic profit would be for the project's owner to shut down the project to preserve his or her own economic viability.

A 2020 study conducted upon the offshore wind farms located off of the coastline of Britain in the North Sea have shown that after 10 years, the average output of the newer offshore wind turbines was only slightly exceeding half of the initial output. This consequential drop in economic viability makes the turbines very expensive and inefficient to maintain. The study also showed that the performance of the newer, larger turbines was noticeably worse than that performance of the older turbines.

Response 10.18
This comment is outside the scope of this permitting action. However, EPA notes that the permit contains maximum allowable daily and annual air emissions during the O&M phase in which the Permittee will accomplish any required project maintenance.

Comment 10.19
The 2020 study of offshore wind farms in Britain also showed that the subsea transmission lines were highly notorious for both the severity and the length of their outages. In the United States, the Block Island Wind Farm's offshore cable was exposed due to erosion, with repairs and reburying of the cable taking over six months. These long periods of outages once again mandate the remaining of dirty fuel sources such as oil to maintain the power grid, The additional maintenance and employee costs of these old fossil fuel power plants makes this project even more economically unviable.

Response 10.19
This comment about the economic burden created by the maintenance of the subsea transmission lines and mandating that other oil-fired units remain on the power grid in the event of long

outages from the wind farm is outside the scope of this OCS air permit under the Clean Air Act. Any regular maintenance that the Permittee will need to accomplish during the O&M phase will need to comply with the maximum allowable daily and annual emission limits, and all other relevant permit requirements, applicable during the O&M phase.

We note that the subsea transmission lines are regulated by the National Oceanic and Atmospheric Administration (NOAA). *See* https://www.noaa.gov/submarine-cables. In addition, BOEM's ROD (page 87 of 208) lists special requirements that the project must comply with related to the routing, burial, and protection measures of the transmission cables. *See* Response 4.1 for a link to the ROD.

Comment 10.20
The proposed Atlantic Shores turbines have no planned secure barriers or surveillance, leaving them open to be undermined by foreign or domestic intrusions, thus having a potentially significant deleterious effect on the energy security of the United States.

Response 10.20
This comment is outside the scope of EPA's action on Atlantic Shores' OCS permit application under the Clean Air Act. However, EPA notes that Section 4 of Appendix A of the ROD (beginning on page 101 of 208) includes anticipated conditions of the Construction and Operations Plan Approval related to National Security. *See* Response 4.1 for a link to BOEM's ROD.

Comment 10.21
In terms of good tank design, we strongly recommend the installation of floating roof tanks. Given that the storage tanks will be storing diesel, a highly volatile petroleum product with high concentrations of VOCs, the floating roof tank provides the best design in order to minimize volatilization of the diesel. As the name suggests, this design consists of a floating roof that falls or rises according to the level of oil in the tank and therefore prevents the build-up of vapor inside the tank.

In terms of good operating and maintenance practices, we strongly recommend the usage of control technology when performing the following actions: filling the tank; landing the roof (emptying the tank); and cleaning the tank. These are the operating scenarios that generate the highest amounts of fugitive emissions coming from the tank. This occurs given the change in internal pressure in the tank. By using mobile (portable) control technology, these emissions are significantly minimized.

We recommend utilizing the NJDEP as a resource to determine how to best conduct these operating scenarios and further understand the difference between the usage of a floating roof tank and for example a fixed-roof tank.

Response 10.21
The permit outlines that the ULSD storage tanks will be light colored with a good tank design. In an effort to minimize emissions, the manufacturer's storage, operating, and maintenance procedures will be followed. Additionally, submerged fill will be utilized which adds the liquid fuel in beneath the liquid-vapor line, further preventing vaporization of the fuel. And, the permit

contains a limit on fugitive emissions of volatile organic compounds from these tanks. The exact final specifications of the USLD storage tanks are not known at this time. However, we expect these tanks to be subject to N.J.A.C. 7:27-16, "Control and Prohibition of Air Pollution by Volatile Organic Compounds" which prescribe state regulatory standards for such tanks.

Comment 10.22
Additionally, Representative Chris Smith (4th NJ) has called for a report to study offshore wind projects in the North Atlantic and Mid-Atlantic Planning Areas and their potential to weaken, degrade, interfere with, or nullify the performance and capabilities of radar relied upon by commercial aviation, military aviation, space launch vehicles, or other commercial space launch activities; and the development of offshore wind projects in the North Atlantic and Mid-Atlantic Planning Areas potential to degrade the capabilities of the Federal Aviation Administration to monitor United States airspace, or hinder commercial, private, or military aviation activities. We implore that this study be completed and published to ensure the protection of the airspace not just over the Borough of Sea Girt, but along the eastern seaboard of the United States.

Response 10.22
This comment is not under the purview of the Clean Air Act. However, we note that the ROD addresses concerns regarding radar interference:

> *Due to the potential interference with IOOS HF [Integrated Ocean Observing System – High Frequency]-radar and the risk to public health, safety, and the environment, the Lessee must mitigate unacceptable interference with IOOS HF-radar from the Project. The Lessee must mitigate interference before commissioning the first WTG [Wind Turbine Generator] or before blades start spinning, whichever is earlier, and interference mitigation must continue throughout operations and decommissioning until the point of decommissioning where all rotor blades are removed.*

The Federal Aviation Administration (FAA) was also involved to ensure compliance with their regulations. For more information regarding aviation, *see* Response 10.10.

Comment 10.22
Many assumptions about offshore wind farms in the Atlantic Shores Project are largely based upon European models. However, there is a singular wind farm in the Atlantic Ocean off the coast of Brittany, which has only been operational for less than two years. There is little to no information or experience on wind farms in the Atlantic Ocean.

Response 10.22
There is no reason to suspect that wind farms in the Atlantic Ocean will behave differently from European models. In addition, the commenter did not provide any reason why assumptions regarding Atlantic and European wind farms should differ.

Comment 10.23
Commenter respectfully requests that the federal and state government, who have joint and several jurisdictions over this project, identify any health studies that were completed, and how they were incorporated into the Pre-Build Infrastructure (PBI) [Request for Proposal] RFP, to ensure that risk to local residents is minimized. We would like these independent verifiable

comprehensive health studies published, and we would like the RFP for the PBI to be rebid to ensure that the health and safety of the Borough is included as a criteria of the RFP bid, based on the studies indicated – as well as other necessary criteria to ensure residents are protected from ill effects of the project – to the extent possible, without impairing the effectiveness of the project.

Response 10.23
The Pre-Build Infrastructure that the commenter is referring to, relates to certain onshore infrastructure which is outside the scope of this OCS air permitting action under the Clean Air Act.

Section 11.0 – Public Review Process

Comment 11.1
Commenter is disappointed that EPA and BOEM, together with certain New Jersey state agencies, have rushed this process and have been less than transparent. This process of steamrolling through the regulatory process, rather than following a deliberate and transparent process, is contrary to the intent and purpose of the Administrative Procedures Act's provisions regarding public participation and comment. Adequate public participation in the process is essential but lacking. One of the shortfalls in this process is the failure of the EPA to answer questions during the process. Questions were not considered during the August 12 virtual hearing.

Previous public engagement sessions for different parts of the environmental review process, such as the Environmental Impact Statement, did not discuss potential air pollutants in any detail. As a result, the public has not received any informational outreach on the air quality aspects of Projects 1 and 2.

We implore the EPA to change its approach so that it carries out its overarching mandate to protect human health and the environment.

Response 11.1
Under CAA section 165, 42 U.S.C. § 7475, the EPA must issue a final permit decision (i.e., grant or deny a permit) on a PSD air permit application within one year of when EPA determines the application to be complete. The EPA issued a draft permit, and discussed the basis for the draft permit (proposing to grant a permit) in the accompanying Fact Sheet for this project; the EPA accepted public comment on the draft permit for 35 days, from July 12, 2024 to August 16, 2024; and held a virtual public hearing to seek public comments on the draft permit. The length of the public comment period complies with the requirements of 40 C.F.R. Part 124, and EPA held the virtual public hearing to provide the public with an additional manner in which to provide comments. Questions were not considered during the virtual public hearing as EPA sought to maximize the time available to the public to submit oral comments. EPA did not receive any requests to extend the public comment period. The public was able to submit both oral and written public comments, including expressing questions, which we are responding to in this document. EPA's public notice and comment for this permit meets all of the applicable administrative procedures and timelines for this action.

The Clean Air Act (CAA) environmental review of the project is separate from the process for developing and issuing BOEM's Final Environmental Impact Statement. BOEM's Draft Environmental Impact Statement (DEIS) was available for public review and comment on May 15, 2023.

Comment 11.2
A transcript of the public hearing will be created and provided in the docket; however, the transcript has not been made available to the public before the deadline for written comments. While this is likely due to understandable quality control and assurance procedures, the timing means that members of the public interested in commenting on the air permit but unable to attend the single public hearing will not be able to benefit from information shared by other stakeholders in preparing their written comments. Thus, EPA did not factor in enough time for commenting to allow for a more purposeful and meaningful due process.

Response 11.2
The federal regulations under 40 C.F.R. Part 124 do not require EPA to release a copy of the public hearing transcript during the public comment period or prior to final agency action on this project. We note that the public comment period ran until August 16th, 2024, four days after the virtual public hearing was held on August 12th. The purpose of the public hearing was to give the public the opportunity to provide oral comment to the EPA on the draft permit.

Comment 11.3
Regarding the comment period deadline, the public notice included in the official docket listed the deadline as August 13, 2024. However, EPA's website contained text saying that the deadline would be extended to August 16, 2024. There was no notice of the extension posted to the official docket. This caused confusion, as the official docket is typically the most reliable resource for public comment deadlines, but an EPA representative stated at the public hearing that the August 13 date was incorrect, and comments would instead be due on August 16.

EPA, as the federal agency responsible for the permit and for representing the public interest, should have conducted multiple public hearings in advance of the written comment deadline, given official notice of the deadline extension for written comments, and given the public opportunities to be presented with information about the air quality aspects of the projects.

Response 11.3
On July 17, 2024, within the first week of when the public comment period began, EPA extended the public comment period date from August 13th to August 16th, 2024 and as originally scheduled, the public hearing was held on August 12th. The initial public announcement and official docket contain information directing the public to three separate EPA web pages. The announcement of the extension of the public review period was available on all of the three EPA web pages. In addition, this change provided the public with extra time for review.

For further discussion of the adequacy of EPA's public notice and comment process, *see* Responses 11.1, 11.2, and 11.3.

Comment 11.4
Why haven't all residents not been informed of the plans to run massive megawatt cables through our coastal towns. Most residents question whether the state and federal governments are working for the people. Where is the transparency? How did this project get this far?

Why do our state and federal government have this project on a hyper-fast track, without proper vetting? Has there been any real research done regarding the health and environmental impact of running the power of approximately 8 nuclear reactors through our residential communities? If so, please show us.

Response 11.4
See Responses 4.36, 11.1, 11.2, and 11.3. Onshore components related to this project are outside the scope of this OCS air permit. With regards to the timing of the OCS air permitting process under the Clean Air Act, Atlantic Shores initially submitted an OCS air permit application on September 1, 2022. Following submissions of revisions and additional information to the application on multiple dates, EPA found the application complete on August 21, 2023 and issued a draft OCS air permit on July 12, 2024. In line with the public comment period requirements of 40 C.F.R. Part 124, EPA held a 35-day public comment period ending on August 16, 2024, including a virtual public hearing on August 12, 2024. EPA has reviewed the project and the applicant's submission and written the OCS air permit to contain the requirements necessary pursuant to the CAA. EPA has also reviewed and considered all public comments it received, and is addressing those comments in this Response to Comments document.

****

Summary of All Changes from Draft OCS Permit to Final OCS Permit as a Result of Comments Received During the Public Comment Period

Below is a summary of all of the changes EPA made between the draft OCS air permit and final OCS permit as a result of the comments received during the public review period. All of these changes are discussed elsewhere in this Response to Comments document, and are repeated here for the convenience of the reader. Newly added text is indicated in blue bold, and deleted text is indicated in red strikeout. The page number indicated for each change is the page number of the revised language in the final permit.

1) **Page 1: Editorial changes on the signature page:**

Atlantic Shores Offshore Wind Project 1, LLC is hereby authorized to construct and operate ~~the~~ **two** offshore wind farm**s** ~~project~~ located on the OCS within the lease area OCS-A 0499, about 7.6 nautical miles (8.7 statute miles) from the New Jersey shoreline. The construction and operation of the **two** wind farm**s** shall be subject to the attached permit conditions and permit limitations.

2) **Page 7: Editorial changes in the Project Description:**

Atlantic Shores Offshore Wind Project 1, LLC ("Atlantic Shores" or "Permittee"), along with its affiliate, Atlantic Shores Offshore Wind Project 2, LLC ("Atlantic Shores Project 2 Company"), proposes to construct (install) and operate ***two offshore wind farms totaling*** ~~an~~ approximately ***2,840*** ~~2,470~~ megawatts ("MW") ~~offshore wind farms project~~ in the designated Renewable Energy Lease Area OCS-A 0499 awarded by BOEM. The Lease Area covers approximately 102,124 acres located approximately 7.6 nautical miles (8.7 statute miles) from the New Jersey shoreline. Atlantic Shores and its affiliate, Atlantic Shores Project 2 Company, propose to develop the OCS lease area into two wind farms, known as Atlantic Shores Project 1 ("ASP1") (1,510 MW) and Atlantic Shores Project 2 ("ASP2") (**target capacity of 1,327** ~~960~~ MW), collectively referred to as the OCS Facility.

3) **Page 13 – New "/OSS" abbreviation added under the Activity/Vessel Description Column:**

Representative Vessel Types for WTG Installation (for both ASP1 and ASP2[a])	Activity/Vessel Description	Identified in Application as OCS Source? (Y/N)[b]	Marine Engines (per each vessel): Type (Main or Auxiliary), Number & Maximum Engine Power (in kW/engine)
Jack-Up Vessel	WTG/**OSS** Installation	Y	Main engines (4): 3,535, all Category 3. Main engines (3): 2,650, all Category 3. Auxiliary engine (1): 2,650, Category 3.

4) **Page 21- Editorial changes to Condition IV.A.1.a. to include additional uses of the jack-up vessels during the C&C phase listed in the application:**

a. During C&C, the three representative jack-up vessels identified in Table 1A to this permit, **which will be used for installation activities related to the WTGs and/or OSSs and their foundations,** ~~that will be used for the WTGs installation activities~~, shall be the sole marine vessels authorized by this permit to operate as OCS source vessels, as the term is defined in this permit.

5) **Page 21- Correction of a typographical error in Condition IV.A.1.b.:**

b. During O&M, the three representative jack-up vessels which will be used for WTGs Heavy Logistics activities and one additional representative jack-up vessel that will be used for ~~OCS~~ **OSS** major repair, which are identified in Table 1B to this permit, shall be the sole marine vessels authorized by this permit to operate as OCS source vessels, as the term is defined in this permit.

6) **Pages 26-27 – Correction of sequential typographical errors in Condition IV.A.5.:**

Conditions IV.A.5.(**f.,g.,h.,i**.) renumbered to Conditions IV.A.5.(**a.,b.,c.,d**.).

7) **Page 29 – Revision on $PM_{2.5}$ emission factor in Condition IV.B.1.b.**

Maximum Engine Power	NO_x (g/kW-hr)	VOC (g/kW-hr)	CO (g/kW-hr)	PM (g/kW-hr)	PM_{10}* (g/kW-hr)	$PM_{2.5}$* (g/kW-hr)
$130 \leq kW \leq 560$	0.40	0.20	3.5	0.02	0.02	0.0~~1~~**2**

*The PM_{10} and $PM_{2.5}$ (g/kW-hr) emission limits includes both filterable and condensable fractions of PM.

8) **Page 34 - Revision of Condition IV.D.2.d. to address comments received.**

d. Upon a detectable pressure drop that is 10 percent of the original pressure (accounting for ambient air conditions) for any switch or SF_6 gas-insulated bus duct, perform maintenance on an SF_6-insulated electrical switchgear to fix seals as soon as practicable but no later than 5 days after the pressure drop is detected. If repair or replacement cannot occur within 5 days of the detected leak, then the Permittee shall divert power from the affected electrical switchgear(s) and isolate the leak until the repair or replacement can be performed. **If repair or replacement cannot occur within 5 days of the detected leak because dangerous weather conditions prevent the repair within that period, then: 1) the Permittee shall fix seals at the soonest weather-permitting accessible day but no later than 14 days after the pressure drop is detected; and 2) if the repair cannot occur within 14 days of the detected leak then the Permittee shall divert power from the affected electrical switchgear(s) and isolate the leak until the repair or replacement can be performed.** The Permittee shall document and maintain records of the equipment repaired or replaced, including but not limited to, the estimated time of leakage and volume of gas leaked during that time **as well as records and documentation of any claim(s) that dangerous weather delayed repair or replacement.** [40 C.F.R. § 52.21]

9) **Page 34 – Revision of Condition IV.D.2.e. to address two comments received.**

e. If an event requires the removal of a switchgear, the ~~affected~~ **damaged** major components will be replaced with new components **or repaired in accordance with OEM recommended procedures.** For purposes of this requirement, an event means when any component of a switchgear is damaged and results in SF_6 leakage that cannot be repaired on site. **The Permittee shall consider the technical and economic viability of installing SF_6-free switchgears whenever an SF_6-containing switchgear needs to be replaced with a new one and install the SF_6-free switchgear, if deemed technically feasible. The Permittee shall keep a record of this decision and its basis for each replaced switchgear.**

10) **<u>Page 41 – Correction of a typographical error in Condition IV.H.1.b.1.</u>**

b. 9.09 tpy of VOC, from the following source:

1) Logan Generating Plant, NJDEP Program Interest number PI 5583**4**, 76 RT 130, South Swedesboro, NJ 08085 (shutdown of emission sources)

11) **<u>Page 42 – Correction of a typographical error in Condition IV.I:</u>**

Condition IV.I.**2**. renumbered to Condition IV.I.**1**.

12) **<u>Page 45 – Revision to Condition V.2.a. to address comments received:</u>**

a. For emission points where visible emissions are observed, the Permittee shall initiate corrective action within no more than eight hours of the initial observation, **or within no more than 24 hours of the initial observation if limited remaining daylight hours prevent faster action.**

****

Attachment 7:

September 30, 2024 Email from Suilin Chan
to Jennifer Daniels Issuing Permit

Froikin, Sara (she/her/hers)

From:	Chan, Suilin
Sent:	Monday, September 30, 2024 3:27 PM
To:	Jennifer Daniels
Cc:	Stephanie Wilson; Kyle Hilberg; Tompkins, Hilary; ajablonowski@epsilonassociates.com; Ruvo, Richard (he/him/his); Steitz, Francis; Froikin, Sara (she/her/hers); Jon, Frank; Marmo, Brian (he/him/his)
Subject:	Atlantic Shores Final OCS Air Permit
Attachments:	Cover Letter for ASOW Final OCS Permit r.pdf; ASOW Final OCS Permit Sept. 29 2024r.pdf; ASOW EPA Response to Comments Sept. 29, 2024r.pdf

Dear Ms. Daniels,

The Outer Continental Shelf air permit application for Atlantic Shores Project 1 and Project 2 has been approved. Attached are the final OCS permit and the Response to Comments document, as well as a cover letter. Please note that the final permit does not take effect immediately. It will become effective on October 30, 2024 (30 days after service of notice) unless a petition for review is filed with the EPA's Environmental Appeals Board (EPA). This final permit may be challenged under the Consolidated Permit Regulations, codified at 40 C.F.R. Part 124, that apply to the EPA's processing of this permit. Specifically, 40 C.F.R. § 124.19 establishes the following procedures for administrative appeal of the final permit. Any person who filed comments on the draft permit or participated in a public hearing on the draft permit may petition the EAB to review conditions of the final permit. Additionally, any person who failed to file comments or failed to participate in the public hearing on the draft permit may petition for administrative review of any permit conditions set forth in the final permit, but only to the extent that those final permit conditions reflect changes from the proposed draft permit. Any petition for review under this part must be filed with the Clerk of the EAB within thirty (30) days of the service of notice of the final permit. A petition for review must contain the information and demonstration required by 40 C.F.R. § 124.19(a)(4) and meet the filing and service requirements of 40 C.F.R. § 124.19(*i*), including service upon the EPA at the following email address:

Richard Ruvo
Director, Air and Radiation Division
Email: ruvo.richard@epa.gov

After any petitions are reviewed by the EAB and a decision is rendered, judicial review of the agency's final action is available in the United States Court of Appeals under 5 U.S.C. § 704 within 60 days from the date on which notice of the action appears in the Federal Register. A petition to the EAB for administrative review is a prerequisite to seeking judicial review.

Please refer to the Consolidated Permit Regulations, codified at 40 C.F.R. § 124.19 for information concerning the appeal procedures.

Sincerely,
Suilin Chan

Vxlolq#Z1#Fkdq#
Vxshuylvru#¦#Shuplwwlqj#Vhfwlrq#¦#Dlu#dqg#Udgldwlrq#Glylvlrq#¦#XV#HSD#Uhjlrq#5#¦#Riilfh=#+545,#96:0734<

Attachment 8:

Final Permit Issued September 30, 2024

U.S. Environmental Protection Agency
Region 2

OUTER CONTINENTAL SHELF AIR PERMIT

Issued to

Atlantic Shores Offshore Wind Project 1, LLC

For the

Atlantic Shores Project 1 and Project 2

EPA Permit Number: OCS-EPA-R2 NJ 02

Issue Date: 09/30/2024 Effective Date: 10/30/2024.

In accordance with the provisions of section 328 of the Clean Air Act, 42 U.S.C. § 7627, and the implementing Outer Continental Shelf ("OCS") air regulations at title 40 of the Code of Federal Regulations ("C.F.R."), Part 55, the United States Environmental Protection Agency, Region 2 Office ("EPA") is issuing an OCS air quality permit to:

Atlantic Shores Offshore Wind Project 1, LLC
1 Dock 72 Way, Floor 7
Brooklyn, NY 11205

Atlantic Shores Offshore Wind Project 1, LLC is hereby authorized to construct and operate two offshore wind farms located on the OCS within the lease area OCS-A 0499, about 7.6 nautical miles (8.7 statute miles) from the New Jersey shoreline. The construction and operation of the two wind farms shall be subject to the attached permit conditions and permit limitations.

Richard Ruvo
Digitally signed by RICHARD RUVO
Date: 2024.09.29 15:14:13 -04'00'

Richard Ruvo, Director
Air and Radiation Division

09/29/2024
Date

I. OCS Facility Limits on Daily Emissions

1. The Permittee shall comply with the following limits on the OCS Facility's daily emissions, expressed as tons per day ("tpd") and included in Table 7. These limits are derived from the emissions modeled in the application and ensure compliance with the NAAQS and PSD increments. [40 C.F.R. § 52.21]

Table 7 – OCS Facility Daily Emissions Limits (in tpd)

Project Phase	NO_x	CO	PM_{10}	$PM_{2.5}$	SO_2*
C&C	17.14	5.50	0.55	0.53	0.05
O&M	5.46	1.27	0.17	0.28	0.01

*While SO_2 emissions do not trigger PSD review and were not modeled, this maximum limit was incorporated in the air quality/AQRV analyses. Therefore, it is an enforceable limit.

2. Compliance with the C&C and O&M emission limits (in tpd) in Table 7 shall be determined by the sum of each pollutant emitted from each type of emission sources below. [40 C.F.R. § 55.2]

   a. Emissions from engines located on the WTGs and/or OSSs;
   b. Emissions from marine engines while the vessels are OCS sources;
   c. Emissions from marine engines while the vessels are at the OCS Facility, but are not OCS sources;
   d. Emissions from marine engines of vessels servicing or associated with the OCS Facility while the vessels are en route to and from the OCS Facility and within 25 nm of the OCS Lease Area boundaries, including those emissions that may occur within state waters (e.g., less than 3 nm from the New Jersey shoreline); and
   e. Emissions from all non-marine engines.

3. Emissions of NO_x, CO, PM_{10}, $PM_{2.5}$, and SO_2 from each marine and non-marine engine, for each air pollutant, shall be calculated daily using the formula below. [40 C.F.R. § 55.8, N.J.A.C. 7:27-22.19]

$$E = \mathrm{kW} * \text{Engine load factor } (\%) * \frac{\text{Hours}}{\text{day}} * \text{Emission Factor} \left(\frac{\text{g}}{\text{kW}-\text{hr}}\right) * 1.10231 * 10^{-6}$$

Where:

- E = actual emissions for a given engine in tons/day
- kW = the maximum engine power (kW) of the relevant marine or non-marine engine
- Engine load factor (%) = the engine daily load factor for a given marine or non-marine engine, calculated as follows:
  - For each marine engine of a marine vessel, the load factor (%) shall be calculated and recorded daily by dividing the actual daily fuel use rate (gallons/day) (i.e., actual

daily fuel use rate shall assume 24 hours/day) of a specific vessel by the maximum daily fuel rate for the vessel (gallons/day, assuming all vessel engines operating at their maximum rated kW power for 24 hours/day). The calculated daily load factor (%) shall apply to each marine engine of that vessel.

- If the daily load factor is not calculated on a certain day, the Permittee shall (1) assume 100% load for all marine engines of the marine vessel while the marine vessel is at the OCS Facility, regardless of whether the vessel is an OCS source; and (2) use the load factors from the application for all marine engines of marine vessels servicing or associated with the OCS Facility, while within 25 nm of the OCS Lease Area boundaries and keep a record of the day and why it was unable to determine the actual engine daily load factor for that particular day.

- For each non-marine engine used to power OSSs and WTGs during C&C and the non-marine engines permanently located on the OSSs during O&M, the daily load factor (%) shall be calculated and recorded daily by dividing the actual daily fuel use rate (gallons/day) (i.e., actual daily fuel use rate shall assume 24 hours/day) of a specific engine by the maximum daily fuel rate for that engine (gallons/day, assuming engine operating at their maximum rated kW power for 24 hours/day). The calculated daily load factor (%) shall apply to each non-marine engine.

- Hours/day = the number of hours the relevant marine or non-marine engine is in operation, which shall be monitored and recorded daily.
  - For each marine engine on a vessel, this includes the hours the engine is in operation when the vessel is either an OCS source or is not an OCS source but is at the OCS Facility or within 25 nm from the OCS Lease Area boundaries.
  - For each non-marine engine, this includes the hours each engine is in operation.

- Emission factor (g/kW-hr):

  <u>The emission factor (in g/kW-hr) for marine engines located on vessels that are OCS sources</u>:

  - The NO_x, CO, VOC, PM, PM_{10}, $PM_{2.5}$ emission factors (in g/kW-hr) used in this formula shall be the BACT/LAER/SOTA NO_x, CO, VOC, PM, PM_{10}, $PM_{2.5}$-specified in this permit. Alternatively, the Permittee may use lower NO_x, CO, VOC, PM, PM_{10}, and $PM_{2.5}$ emission factors (in g/kW-hr) that correspond to higher Tier marine engines emission standards if the Permittee actually uses higher Tier marine engines than are those listed in this permit; in this case, the emission factors shall be derived from the Tier emission standards from EPA-issued certificate of conformity for each applicable engine containing the emission standards in 40 C.F.R. Part 60, Subpart IIII, Tier Marine Standards at 40 C.F.R. Part 1042, engine manufacturer specifications, or site-specific testing derived factors.

If the engine emission standards are presented as NOx + hydrocarbon (HC), or NOx + NMHC, derive NO_x, HC, and NMHC emission factors as specified in footnote 5 of this permit.

- For the NO_x emission factor (in g/kW-hr) for Category 3 marine engines subject to the NSPS IIII emission standards, the Permittee may alternatively choose to use the actual NO_x (g/kW-hr) values determined during the performance tests required in the permit.

- For the SO_2 emission factors (in g/kW-hr) for Category 3 marine engines, the Permittee may alternatively choose to use an SO_2 emission factor based on the actual sulfur content of fuel used.

- <u>The emission factor (in g/kW-hr) for marine engines located on vessels that are not OCS sources, during the times the vessels are at the OCS Facility or within 25 nm from the OCS Lease Area boundaries</u>:

  The NO_x, CO, VOC, PM, PM_{10}, and $PM_{2.5}$ emission factors (g/kW-hr) shall be determined based on the Tier emission standards for the actual Tier to which each marine engine that the Permittee uses is certified. For those air pollutants for which no Tier emission standards are available, the Permittee shall use emission factors (g/kW-hr) from the engine manufacturer specifications, or emission factors (g/kW-hr) derived from performance testing data conducted for similar engines.

- For marine engines covered by this permit, the CO_2, CH_4 and N_2O emission factors (g/kW-hr) used to calculate the engine's CO_2e emissions should be equal to the emission factors provided in the April 2022 EPA Ports Emissions Inventory Guidance (2022 EPA guidance document).

- PM_{10} is assumed to be equal to PM, based on conservative engineering judgement. Per the 2022 EPA guidance document, for all marine vessels firing ULSD, $PM_{2.5}$ is assumed to be 97% of the PM_{10} value for Categories 1 and 2 engines, and 92% of the PM_{10} value for all Category 3 engines.

- <u>The emission factor (in g/kW-hr) for non-marine engines covered by this permit</u>:

- The NO_x, CO, VOC, PM, PM_{10}, $PM_{2.5}$, and emission factors (g/kW-hr) shall be the BACT/LAER/SOTA NO_x, CO, VOC, PM, PM_{10}, $PM_{2.5}$, emission limits (g/kW-hr) specified in this permit.

- For the SO_2 emission factors (in g/kW-hr) for non-marine engines, the Permittee may choose to use an SO_2 emission factor based on the actual sulfur content of fuel used.

- For non-marine engines covered by this permit, the CO_2, CH_4 and N_2O emission factors (lb/MMBTU) used to calculate the engine's CO_2e emissions may be based on

Tables C-1 and C-2 of 40 C.F.R. Part 98.

- $1.10231 * 10^{-6}$ = grams to tons conversion factor
- 1/2,000 = lb to ton conversion factor

4. The Permittee shall calculate the daily emissions in tons of each air pollutant emitted by each relevant marine and non-marine engine, each calendar day using the formula above.

5. The sums of the actual tons of NO_x, CO, PM_{10}, $PM_{2.5}$, and SO_2 emissions per day for each relevant marine and non-marine engine, calculated using the method provided above, shall be used to demonstrate compliance with the OCS Facility Daily Emissions Limits (in tpd) specified in Table 7 of this permit.

V. SMOKE, ODORS, OPACITY LIMITATIONS AND MEASUREMENTS, AND CRANKCASE EMISSIONS

1. The Permittee shall ensure that each marine engine of any jack-up vessel that is an OCS source, and each non-marine engine (portable diesel generator engines used during C&C, and permanent diesel generator engines on OSSs during O&M), shall not cause smoke the shade or appearance of which is darker than number 1 on the Ringlemann smoke chart or greater than 20 percent opacity, exclusive of visible condensed water vapor, to be emitted into the outdoor air from the combustion of fuel in any stationary internal combustion engine or any stationary turbine engine for a period of more than 10 consecutive seconds. [N.J.A.C. 7:27-3.5]

2. For each marine engine of any jack-up vessel that is an OCS source, the Permittee shall conduct a one-minute visible emissions survey of the engine's emission points, each day during C&C and O&M that the engine operates. The survey shall be conducted using EPA test Method 22, while the engine is operating. No more than four emission points shall be observed simultaneously.

   a. For emission points where visible emissions are observed, the Permittee shall initiate corrective action within no more than eight hours of the initial observation, or within no more than 24 hours of the initial observation if limited remaining daylight hours prevent faster action.

   b. If, after taking the corrective action, the visible emissions persist, the Permittee shall perform an EPA test Method 9 visual determination of opacity in accordance with 40 C.F.R. § 60, Appendix F, within 24 hours of the initial observation.
   [40 C.F.R. § 55.8]

3. The Permittee shall conduct, annually, an EPA test Method 9 visual determination of opacity in accordance with 40 C.F.R. Part 60, Appendix F for each permanent diesel generator engine on the OSSs during O&M. [40 C.F.R. § 55.8]

Table 1A – Representative Types of Marine Vessels, and Associated Main and Auxiliary Marine Engines, to be Used During C&C, as Described by Atlantic Shores, for Each of the Following Activities.

Representative Vessel Type for WTG and OSS Foundation Installation (for both ASP1 and ASP2[a])	Activity/Vessel Description	Identified in Application as OCS Source? (Y/N)[b]	Marine Engines (per each vessel): Type (Main or Auxiliary), Number & Maximum Engine Power (in kilowatts (kW)/engine)
Heavy Lift Vessel (HLV)	Medium HLV	N	Main engines (4): 3,840 Main engines (2): 4,800 Auxiliary engine (1): 1,110
Tug	Bubble Curtain Support Vessel	N	Main engines (2): 5,530
Barge 1	Barge	N	Auxiliary engine (1): 50
Barge 2	Barge	N	Auxiliary engine (1): 50
US Towing Tug 1	US Towing Tug	N	Main engines (2): 2,525 Auxiliary engines (3): 79
US Towing Tug 2	US Towing Tug	N	Main engines (2): 2,525 Auxiliary engines (3): 79
Crew Transfer Vessel	Crew Transfer/Protected Species Observer (PSO)/Noise Monitoring Vessel	N	Main engines (4): 522 Auxiliary engines (2): 27
Bubble Curtain Power[c]	Air Compressor	N	Auxiliary engines (20): 399
Hydraulic Hammer Power[c]	Hydraulic Hammer Engine	N	Auxiliary engines (3): 597
Heavy Lift Vessel (HLV)	Large HLV	N	Main engines (11): 4,182 Auxiliary engine (1): 5,833
Tug	Bubble Curtain Support Vessel	N	Main engines (2): 5,530
Barge	Transport Barge 1	N	Auxiliary engine (1): 50
Barge	Transport Barge 2	N	Auxiliary engine (1): 50

[a] ASP1 and ASP2 will each use the same set of vessels.
[b] This column indicates whether the applicant represented that the vessel would be an OCS source.
[c] This is not a vessel type. This is an engine that can be located on any of the vessel types or a barge with no propulsion engine. Atlantic Shores has expressed it does not expect to locate this engine on an OCS source vessel, but note that the OCS source status of the actual vessel on which the engine is located may impact the requirements applicable to this engine.

Attachment 9:

September 30, 2024 Email
from Maya Greally to Commenters

Froikin, Sara (she/her/hers)

From: Greally, Maya
Sent: Monday, September 30, 2024 4:21 PM
Subject: U.S. EPA Issues Final Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit
Attachments: Atlantic Shores Offshore Wind EPA Final OCS Permit.pdf; Atlantic Shores Offshore Wind EPA Response to Comment.pdf

Hello,

Thank you for providing public comment on the Outer Continental Shelf air permit for the Atlantic Shores Offshore Wind Project.

I am writing to inform you that the U.S. Environmental Protection Agency has issued its final Outer Continental Shelf, or OCS, air permit to Atlantic Shores Offshore Wind Project 1, LLC for the construction and operation of a wind-to-energy project, consisting of two wind farms (Atlantic Shores Project 1 and Project 2), located 8.7 miles from the New Jersey shoreline near Atlantic City, New Jersey.

The final permit and the Response to Comments are attached to this email. These documents in addition to other supporting documents, are available on the EPA Region 2 Clean Air Act permitting website at www.epa.gov/caa-permitting/caa-permits-issued-epa-region-2 or in the administrative docket at www.regulations.gov under docket number EPA-R02-OAR-2024-0312.

The EPA has made changes to the OCS air permit based on comments received during the draft OCS permit public comment period. Therefore, the final OCS air permit will become effective **30 days** after the service of notice, unless a petition for review is filed. Service of notice means notifying the permittee, public commenters, and others who requested notice. More information about requesting a petition for review is included at the bottom of this email.

If you have any questions about the final OCS air permit, please feel free to reach out to me, the EPA's Community Involvement Coordinator, at greally.maya@epa.gov or 212-637-3588.

Information Regarding Petitions for Review under 40 C.F.R. § 124.19 and Appeals

Since comments requesting changes to the draft permit were received and changes were made, the final OCS air permit will become effective **thirty (30) days** after the service of notice, unless a petition for review is filed. If a petition for review of the final permit is filed, the permit will not become effective until after the Environmental Appeals Board, or EAB, makes a decision on the petition.

The final permit may be challenged under the Consolidated Permit Regulations, codified at 40 C.F.R. Part 124. Specifically, 40 C.F.R. § 124.19 establishes the following procedures for administrative appeal of the final permit:

- Any person who filed comments on the draft permit or participated in a public hearing on the draft permit may petition the EAB to review the conditions of the final permit.
- Any person who failed to file comments or failed to participate in the public hearing on the draft permit may petition for administrative review of any permit conditions set in the final permit, but only to the extent that those final permit conditions reflect changes from the proposed draft permit.
- Any petition for review under this part must be filed with the Clerk of the EAB within **thirty (30) days** of the service of notice of the final permit.

- A petition for review must contain the information and demonstration required by 40 C.F.R. § 124.19(a)(4) and meet the filing and service requirements of 40 C.F.R. § 124.19(*i*), including service upon the EPA at the following email address:
  Richard Ruvo
  Director, Air and Radiation Division
  Email: ruvo.richard@epa.gov

For answers to frequently asked questions about 40 C.F.R. § 124.19, visit:
https://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/General+Information/Frequently+Asked+Questions

The requirements of 40 C.F.R. § 124.19 can be found here: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-124/subpart-A/section-124.19

After any petitions are reviewed by the EAB and a decision is made, judicial review of the agency's final action is available in the United States Court of Appeals under 5 U.S.C. § 704 within **60 days** from the date on which notice of the action appears in the Federal Register. A petition to the EAB for administrative review is a prerequisite to seeking judicial review.

Maya Greally *(she/they)*
Community Involvement Coordinator
U.S. Environmental Protection Agency | Region 2

Office: 212-637-3588
Work Cell: 929-656-3415
Email: greally.maya@epa.gov

290 Broadway, 26th floor, New York, NY 10007
Website | Facebook | Twitter

Attachment 10:

September 11, 2023 Letter
from Kyle Hilberg to Suilin Chan

September 11, 2023

Suilin W. Chan, Chief Permitting Section
Air and Radiation Division
United States Environmental Protection Agency
Region 2
290 Broadway
New York, NY 10007-1866
Via email at Chan.Suilin@epa.gov

Subject: Atlantic Shores Offshore Wind LLC – Outer Continental Shelf Air Permit Application

Dear Ms. Chan:

Thank you for your comments of August 21, 2023 on the air permit application for the proposed Atlantic Shores South Projects which propose to construct, operate, and decommission two offshore wind energy generation projects in Lease Area OCS-A 0499.

As you know, the Atlantic Shores Projects are a critically important response to initiatives by the Biden and Murphy Administrations to reduce our nation's dependence on fossil fuels, halt climate change, and reduce air quality impacts on sensitive populations. Our application documents substantial reductions in greenhouse gas emissions, as well as criteria pollutants and air toxics emissions in and near Environmental Justice populations.

In reviewing our attached responses, and per our prior discussions and correspondence, we ask that EPA consider the following:

- Vessel Emissions: Modeling of moving vessel engines, over water, is fundamentally different than fossil fuel smokestack modeling and requires a different approach. Mobile sources are not stationary sources, nor are vessels in transit OCS sources, and they should not be treated as such. While we must model potential emissions from vessels in transit while enroute to an OCS source within 25 miles of the source, EPA has explained that the Clean Air Act does not authorize EPA to regulate emissions from engines of vessels in transit.[1] EPA should thus not impose emission limits on such vessels. By imposing such restrictions, EPA will restrict how vessels operate based on unrealistic, hour-based modeling conditions that will likely increase actual emissions (since vessels would be forced to stop work and idle to avoid overly restrictive limits, prolonging operational periods, and therefore, emissions). Additionally, restrictions on vessel operability could pose risks to workers by inhibiting vessel ability to respond to unpredictable events like weather, marine wildlife, or marine debris.

[1] *See Outer Continental Shelf Air Regulations*, 57 Fed. Reg. 40,792, 40,793-94 (Sept. 3, 1992).

- Potential Emissions: Potential emissions used for modeling should utilize maximum emissions from a source taking into consideration inherent physical limitations and operational design features of the equipment. Moreover, potential emissions should not be based on hypothetical, unrealistic scenarios that do not reflect normal, intended operation of the equipment. In other words, potential emissions are not meant to hypothesize the worst-case conceivable operation, but rather to look at maximum emissions generated while operating the equipment as it is intended to be operated.

- Public Health: The National Ambient Air Quality Standards are intended to be protective of public health in the ambient air. Ambient air is that part of the atmosphere that the general public has access to, which is not the case for much of the receptors being modeled here. Any such members of the public would need to continuously or repeatedly spend time at a single offshore location, miles from landfall. Nevertheless, even interpreting ambient air to include such areas, the revised modeling we have submitted documents that the project will not cause or significantly contribute to standard exceedances, even miles offshore and within the wind development area itself. The modeling is highly conservative by assuming the confluence of multiple layers of unlikely conditions, providing further reassurance that any members of the public will not experience harmful air quality impacts.

- Selection of Vessels: Offshore wind is in its infancy in the United States. It is unrealistic and inappropriate to require developers to select specific vessels at this stage of a project and while still in the midst of environmental review under the National Environmental Policy Act. Per the EPA's Fact Sheet for the South Fork Wind LLC air permit[2]: "finding the vessels needed for a windfarm of this size and complexity at the time they are needed to meet established construction schedules is difficult." We are competing for resources with offshore wind projects outside the United States, and putting restrictions on specific construction vessels will imperil our ability to bring this air quality improvement project to the marketplace.

- As provided in the 40 C.F.R. Part 55 regulations, "in implementing, enforcing and revising this rule and in delegating authority hereunder, [EPA] will ensure that there is a rational relationship to the attainment and maintenance of Federal and State ambient air quality standards and the requirements of part C of title I, and that the rule is not used for the purpose of preventing exploration and development of the OCS."[3] We request that EPA consider this principle in evaluating our responses provided herein.

---

[2] See *FACT SHEET: Outer Continental Shelf Preconstruction Air Permit 130 MW Offshore Windfarm South Fork Wind, LLC EPA Draft Permit Number OCS-R1-04*

[3] 40 C.F.R. § 55.1.

Sincerely,

DocuSigned by:
Kyle Hilberg
DFCC2D5441274F8...

Kyle Hilberg
Permitting Lead

Attachment: Comment Responses

This document comments of August 21, 2023 on the air permit application for the proposed Atlantic Shore Wind farm which proposes to construct, operate, and decommission two offshore wind energy generation projects in Lease Area OCS-A 0499. This document copies comments from the August 21, 2023 letter in boxes, followed by the Atlantic Shores replies.

Attachment 1, air quality impact assessment:

1. Section 2 of the July 20, 2023 submittal titled "Project and Calculation Changes" contains 3 revisions to the September 1, 2022 application. There is insufficient description of how the emission rates were changed from the September 1, 2022 application and how the changes were incorporated into the modeling analysis. The application must include a discussion on any assumptions made that would affect the modeled emission rate.

The July 20, 2023 submittal descriptions are repeated below, followed by further description *in italics* of how the emission rates were changed from the September 1, 2022 application and how the changes were incorporated into the modeling analysis.

- Section 2.1.1: the load factor is adjusted for vessel main engines associated with foundation and offshore substation (OSS) installation (which will be drifting at night and when not in active operations), based on revisions to the projected operations of these vessels. *Based on the description of operations relative to the default load factors, load factors are adjusted from 0.2 to 0.1. This is reflected in the following sheets and cells in the spreadsheets provided June 30, 2023 Excel File: ASOW Calcs Construction Only – OCS Applicability 6-27-2023.xlsx, Sheets: Construction, Construction Project 1, and Construction Project 2, Cells: S6, S10, S14, S18, S22, S26, S30, S37, S41, S45, S49, S53, S57, S61, S65, S69, S73, and S77. Those changed inputs were incorporated into the modeling analysis.*

- Section 2.1.2: the particulate matter (PM2.5 and PM10) emission rates for the compressor generators reflect the use of engines compliant with European Union Stage III B emission standards based on current expected design. *The relevant European Union Stage III B emission standards are 0.025 grams per kilowatt-hour. The use of these emission rates is reflected in the following sheets and cells in the spreadsheets provided June 30, 2023: Emissions Factors Update: Excel File: ASOW Calcs Construction Only – OCS Applicability 6-27-2023.xlsx, Sheet: Emissions and Load Factors, Cells: A45-O45 and Emissions Calculations: Sheets: Construction, Construction Project 1, and Construction Project 2, Cells: U33-AJ33, AN33-BC33, U80-AJ80, and AN80-BC80. Those changed inputs were incorporated into the modeling analysis.*

- Table 2-1: Construction and O&M emissions totals are replaced by the totals in the revised calculations supplied June 30, 2023. *The new totals are reflected in the following sheets and cells in the spreadsheets provided June 30, 2023: Construction: Excel File: ASOW Calcs Construction Only – OCS Applicability 6-27-2023.xlsx, Sheet: Total Construction Summary, Cells: V13-AK13 (Construction Total OCS Emissions) and AO13-BD13 (Construction Peak Year OCS Emissions). Operation and Maintenance: Excel File: ASOW OM Only Calcs OCS Applicability_6-27-23.xlsx, Sheet: O&M South Summary, Cells: C32-R32. These totals reflect the changes* *described above and the elimination of some duplicative vessel trips in the original calculations. They also reflect use of a smaller Heavy Lift Vessel (HLV) for offshore substation (OSS) installation.*

Please confirm that AS modeled the full 24-hour period and did not average across non-operating hours including for the hydraulic hammer and air compressors. Hourly emissions modeled for less than 24 hours will be so restricted by permit conditions.

AS modeled the full 24-hour period and did not average across non-operating hours including for the hydraulic hammer and air compressors. See our comment response below regarding permit conditions.

please clarify the use of the EMISFACT and HROFDAY keyword in the input files.

The "Variable Emissions Type" with its associated EMISFACT and HROFDAY keywords in the input files reflect how AERMOD is treating sources that move over the course of the day. For example, Source IDs "CIVAE" and "CIVME" are the auxiliary and main engines for the cable laying vessel, moving slowly along the cable route over the course of the day. The vessel is modeled as emitting 24 hours per day.

2. Please confirm that the modeled emission rates are the maximum hourly emission rates since these will become permit limits.

The modeled emission rates are as-described in the application, notably Section 2.1 and Section 2.1.1. The modeled emission rates are the projected emissions based on the maximum rated capacity of the equipment and maximum throughput of the facility, calculated based on detailed plans for each activity, load factors, and emission factors.

The calculation methodology is consistent with the three offshore wind OCS permits/draft permits issued by EPA as follows:

- Vineyard Wind LLC, OCS-R1-03: EPA's Fact Sheet and Statement of Basis at Sections 1.a. and 1.b. contain the "WDA [Wind Development Area] facility's estimated emissions during the construction phase" and the "estimated emissions for the WDA facility during the operational phase" respectively.

- South Fork Wind, LLC, OCS-R1-05: EPA's Fact Sheet and Statement of Basis at Tables 1 and 2 contain the "Estimated Construction OCS Emissions (tons)" and the "Estimated Operations and Maintenance Emissions (tpy)."

- Revolution Wind, LLC, OCS-R1-05 [draft]: EPA's Fact Sheet and Statement of Basis at Tables 1 and 2 contain the "Estimated Construction OCS Emissions (tons per year (tpy)) for the Revolution Wind Project" and the "Estimated Operations and Maintenance Emissions (tpy)."

Any emissions limits should apply to regulatorily defined "OCS sources" only,[1] and not vessels transiting to and from the OCS sources. The regulations at 40 C.F.R. Part 55 (and its underlying statutes) require the inclusion of emissions from vessels servicing or associated with OCS sources when calculating the "potential to emit" for the purposes of determining the applicability of specific regulatory programs per 40 C.F.R. §§ 55.13 and 55.14. *See also* 40 C.F.R. § 55.2 (Definition of "potential to emit," includes "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"). However, these vessels do not meet the definition of "OCS source" and their transit emissions should not be subject to emissions limits or best available control technology requirements consistent with EPA guidance.[2]

3. The Significant Impact Area (SIA) extends to 50 km for the 1-hour NO2 NAAQS for both the construction, and operation and maintenance phases, and for the 24-hour PM2.5 NAAQS and Class II increment during the construction phase. Note that we understand that AERMOD's gaussian assumption is not valid beyond 50 km. Please provide information showing that the NAAQS and PSD Class II increment requirements are met beyond 50 km.

We note the statements in EPA's Guideline on Air Quality Models that maximum source impacts will likely occur within the first 10 to 20 km from the source, and that EPA does not consider a long-range transport assessment beyond 50 km necessary for these pollutants if a near-field NAAQS compliance demonstration is required.

We are providing the following information showing that the NAAQS and PSD Class II increment requirements are met beyond 50 km:

- Clarification that maximum controlling impacts are all in the nearfield. Those impacts are shown in the AERMOD output files; we are providing figures separately to Annamaria Colecchia for ease of review.

- Clarification that there will not be a NAAQS issue onshore. As an example, information in Tables 5-7 and 5-10 can be used to show predicted onshore 24-hour PM2.5 concentrations well below the relevant NAAQS. The details are as follows: direct PM2.5 H2H (conservative) concentration

---

[1] *See* 40 C.F.R. § 55.2 ("OCS source means any equipment, activity, or facility which: (1) Emits or has the potential to emit any air pollutant; (2) Is regulated or authorized under the Outer Continental Shelf Lands Act ("OCSLA") (43 U.S.C. § 1331 et seq.); and (3) Is located on the OCS or in or on waters above the OCS. This definition 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.")

[2] *See Outer Continental Shelf Air Regulations*, 57 Fed. Reg. 40,792, 40,793-94 (Sept. 3, 1992) ("Only the vessel's stationary source activities may be regulated, since when vessels are in transit, they are specifically excluded from the definition of OCS source by statute. . . . Part 55 thus will not regulate vessels en route to or from an OCS facility as "OCS sources," . . . . *Section 328 does not provide authority to EPA to regulate the emissions from engines being used for propulsion of vessels*. . . . All vessel emissions related to OCS activity will be accounted for by including vessel emissions in the 'potential to emit' of an OCS source. Vessel emissions must be included in offset calculations and impact analyses, as required by section 328 and explained in the NPR.") (emphasis added).

of 0.58 µg/m^3 at the Brigantine Wildlife Refuge (representative of the nearest onshore area) plus secondary PM2.5 concentration of 0.024 µg/m^3 plus measured background of 14 µg/m^3 equals 14.61 µg/m^3, well below the NAAQS of 35 µg/m^3.

Section 5.5.3 of our September 1, 2023 application documents why the PSD analysis does not include other increment consuming or expanding sources. Because AS maximum controlling impacts are all in the nearfield, and PSD Class II increment requirements are met at all locations.

4. Please refine your VISCREEN modeling analysis or provide a detailed explanation that demonstrates that the project is in compliance with the 40 C.F.R. § 52.21(o) requirements.

The PSD regulations at 40 CFR 52.21 (o) require AS to provide an analysis. Per the EPA's VISCREEN manual[3], if plume screening calculations using VISCREEN demonstrate that during worst-case meteorological conditions criteria are exceeded, a more detailed plume visual impact analysis to ascertain the magnitude, frequency, location, and timing of plume visual impacts would be required. Such an analysis was submitted as part of the September 1, 2022 application; specifically, per Application Section 5.13.1 the Class I Air Quality Related Values (AQRV) Modeling Report is sufficiently representative of nearby onshore areas that the analysis specific to that Class I area serves to also address the broader visibility analysis per 40 CFR 52.21 (o)(1). Per our response to Attachment 2 (below) the Class I AQRV Modeling Report is being revised to address comments from FWS.

Atlantic Shores notes that the three offshore wind OCS permits/draft permits issued by EPA addressed visibility per 40 CFR 52.21 (o)(1) within the context of operational emissions. See Vineyard Wind LLC, OCS-R1-03 EPA Fact Sheet Page 50, South Fork Wind, LLC, OCS-R1-05 EPA Fact Sheet Page 52, and Revolution Wind, LLC, OCS-R1-05 EPA Fact Sheet Page 80. We are providing a revised VISCREEN analysis separately to Annamaria Colecchia addressing operational emissions.

5. Please see Attachment 2 for a discussion of additional information that must be provided to FWS.

See below for responses.

6. Please explain what is an "elevated volume source" as it was mentioned in Appendix A of the June 30, 2023 submittal and how it was used in the model.

The column "Line Volume Type" is essentially duplicative. It simply indicates that the "Line Volume Height" column shows a non-zero release height.

7. Please explain what a summer campaign is.

Routine O&M activity is scheduled predominately for good weather, and for periods avoiding benthic resource activity.

[3] Workbook For Plume Visual Impact Screening And Analysis, EPA October 1992.

8. Below are typo-like comments. Please correct these values in the application

Attachment A provides the relevant redline changes. We note that the relevant NJAAQS is a 12-month arithmetic mean per NJAC 7:27-13.8, and our check of the ppm to µg/m^3 conversion resulted in no substantive changes.

Attachment 1, BACT, LAER, and other issues:

1. AS is advised to check the accuracy of its estimated total construction SO2 emissions of 7.3 tons as it will become a limit in the permit.

We have checked the estimated total construction SO2 emissions and it is consistent with the emissions calculation methodology described in the application. As described above any emissions limits should apply to regulatorily defined "OCS sources" only.

2. Provide a simple table listing all potential vessels that will be utilized for this project; whether the vessel will be US or foreign-flagged; and which vessel(s) are anticipated to be an OCS source.

Attachment B provides the requested table with the current design information, consistent with what is used for the emissions calculations and model inputs. AS has not, and cannot, identify all potential vessels and whether an individual vessel will be foreign-flagged.

Note that absent this information identifying which vessels are anticipated to be OCS sources and why, EPA may need to treat all vessels as OCS sources in the draft permit, and include all accompanying requirements.

We note recent examples where EPA has issued an OCS permit with conditions that are triggered if and only if a vessel becomes an OCS source. As an example, the South Fork Wind LLC OCS air permit (OCS-R1-04) at Condition IV.C. has conditions which "apply to all operating engines on a vessel while that vessel meets the definition of an OCS source vessel." We recommend a similar approach here.

3. Provide a table listing each vessel, its marine engines including the category of each engine, and for each engine its size in kilowatt (kW), applicable part 1042 emission standard or NOx Tier emission standard under MARPOL Annex VI, and the emission factors (g/kW-hr) for each air pollutant that AS used for the calculations. Also, the origin of each emission rate and/or how it was derived must be provided.

Engine categories, and applicable part 1042 emission standard or NOx Tier emission standard under MARPOL Annex VI are a function of the country of manufacture, model year, displacement in liters per cylinder, and maximum engine speed in revolutions per minute. Each of these characteristics is specific to the individual engine, and therefore to the individual vessel. Atlantic Shores has not specified or contracted vessels.

The spreadsheets provided (most recently) June 30, 2023 include the emission factors (g/kW-hr) for each air pollutant that AS used for the calculations, the origin of each emission rate, and how it was derived. Attachment C provides an annotated version of the spreadsheet with additional guidance on identifying the relevant information.

Note that, as discussed by phone on August 16, 2023, 40 C.F.R. § 55.7 provides that an OCS source may be exempted from a control technology requirement if EPA finds that compliance with the control technology requirement is technically infeasible or will cause an unreasonable threat to health and safety. Also note that, as discussed by phone on August 16, 2023, 40 C.F.R. § 60.8(b) includes provisions for seeking performance test waivers in certain circumstances.

AS appreciates EPA's notes. Consistent with other offshore wind projects, we're aware of one situation where the cited exemptions and waivers may be relevant. Specifically, in the event that Category 3 marine engines are used while the vessel is an OCS source, those engines could be subject to a particulate matter emission limit in the relevant 40 CFR 60 that may not be achievable or testable. Per our responses above, we do not have specific engine information to know whether the cited exemptions and waivers will be needed.

We do not believe there is any fuel sulfur requirement that would trigger the need for exemptions or waivers. Specifically, NSPS, Subpart IIII fuel requirements for Category 1 and 2 engines at 40 CFR Part 60.4207 point to 40 CFR Part 1090. Under 40 CFR Part 1090, Category 1 and 2 engines on vessels propelled by Category 3 engines can use ECA marine fuel with a max. sulfur content of 1,000 ppm. This obviates the need for separate fuel systems on vessels that have engines falling in different categories.

4. EPA reiterates that AS must submit the offset demonstration required by N.J.A.C. 7:27- 18.3(e) and previously identified in our September 30, 2022 incompleteness letter. … AS must submit CER02 as part of its application and may choose whether to submit CER03 as part of the application or at a later time prior to public notice and comment on the draft OCS air permit.

We reiterate our response from October 28, 2022 that we believe the submittal of a CER02 form is not necessarily required to comply with the general regulatory direction to include an emission offset demonstration with the permit application, and we reiterate our request that EPA review the interpretation requests #8 and #9 in Appendix A of the application, which could impact the number of offsets needed and the available paths to obtain offsets.

That said, AS is in the process of obtaining the requested CER02 form. Because a third party is involved, the exact timing is outside of Atlantic Shores' control, but we expect submittal by October 25, 2023. AS chooses to submit CER03 at a later time.

Attachment 2:

Between the December 2022 response to comments and the July 2023 modeling report, it appears that the short-term emission limits did not decrease significantly. It was our understanding during some coordination conversations that these limits would decrease. Please provide an explanation of the changes.

Efforts between December 2022 and July 2023 focused on discussions with EPA regarding approaches to assess over-water impacts. The most recent submissions reflect nearfield modeling that accounts for the calculation changes described here and changes to vessel positioning.

A similar revision to the CALPUFF modeling of construction AQRV impacts will show a reduction in predicted impacts from the December 2022 submission. That revision is underway with results expected October 25, 2023.

> In order to determine whether the AQRV impacts are only associated with construction, the FWS is requesting that Atlantic Shores South evaluate the potential air quality and AQRV impacts of the long-term operation and maintenance activities at Brigantine Wilderness Area (without construction).

That revision is underway with results expected October 25, 2023.

> In addition, please provide a summary table of emissions and impact results to the Class I area (Brigantine) associated with long-term operation & maintenance activities. We would appreciate if Epsilon highlighted the differences between construction activity/emissions and those from operation/maintenance in the short-term (24-hour maximums). We'd ask that modeling *.inp and *.lst files associated with the CALPUFF modeling system runs be provided.

That revision is underway with results expected October 25, 2023.

Table 3-1 National And New Jersey Ambient Air Quality Standards (Continued)

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)		NJAAQS ($\mu g/m^3$)	
		Primary	Secondary	Primary	Secondary
PM_{10}	24-Hr [6]	150	Same	None	None
Suspended Particulate Matter [7]	24-Hour [1]	None	None	260	150
	Annual [3]	None	None	75	60

[1] Not to be exceeded, more than once per year.
[2] 98th percentile of one-hour daily maximum concentrations, averaged over three years.
[3] annual mean
[4] annual mean, averaged over three years.
[5] 98th percentile, averaged over three years.
[6] Not to be exceeded more than once per year on average over 3 years
[7] NJDEP modeling guidance (2021) states that the Department assumes that if the NAAQS for PM10 and PM2.5 are met, then the TSP NJAAQS will also be met.
[8] arithmetic mean during any 12 consecutive months

~~The NAAQS also reflect various durations of exposure. The short-term periods (24 hours or less) refer to exposure levels not to be exceeded more than once a year. Long-term periods refer to limits that cannot be exceeded for exposure averaged over three months or longer.~~

3.2 Prevention of Significant Deterioration Increments

PSD increments are the maximum allowable increase in concentration that is acceptable to occur above a baseline concentration for a pollutant, for projects subject to PSD review. Class I increments are intended to be protective of Class I areas. Class I areas are geographic areas recognized by the EPA as being of the highest environmental quality and requiring maximum protection; these areas have special national or regional scenic, recreational, or historic value. The nearest Class I area to the WTA is the Brigantine Wilderness area. Class II areas comprise most of the US and there are currently no Class III areas.

Table 3-2 presents the PSD increments subject to modeling for the Projects. PSD review is not triggered for SO_2.

TABLE 3-3 SIGNIFICANT IMPACT LEVELS

Pollutant	Averaging Period	Recommended Significant Impact Levels for NAAQS Analyses (µg/m³)	PSD SIL Increments (µg/m³)	
			Class I	Class II
CO	1-Hour	2,000[1]	None	2,000[1]
	8-Hour	500[1]	None	500[1]
NO_2	1-Hour	7.5[2]	None	None
	Annual	1	0.1[1]	1[1]
$PM_{2.5}$	24-Hour	1.2[3]	0.27[3]	1.2[3]
	Annual	0.2[4]	0.05[4]	0.2[4]
PM_{10}	24-Hour	5[1]	0.3[1]	5[1]
	Annual	1[1]	0.2[1]	1[1]

[1] Concentration not to be exceeded
[2] Highest 1-hour Modeled concentration averaged over ~~5~~3 years
[3] Highest 24-hour modeled concentration averaged over ~~5~~3 years
[4] Highest annual modeled concentration averaged over ~~5~~3 years

3.4 Additional Impact Analyses

40 CFR 52.21 (o)(1) states "the owner or operator shall provide an analysis of the impairment to visibility, soils and vegetation that would occur as a result of the source or modification and general commercial, residential, industrial and other growth associated with the source or modification. The owner or operator need not provide an analysis of the impact on vegetation having no significant commercial or recreational value." 40 CFR 52.21 (o) (2) states "The owner or operator shall provide an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial and other growth associated with the source or modification." Each requirement is addressed below.

3.4.1 Soils, and Vegetative Screening Thresholds

PSD regulations require analysis of air quality impacts on sensitive vegetation types with significant commercial or recreational value or sensitive types of soil. Evaluation of impacts on sensitive vegetation is performed by comparing predicted impacts with screening levels presented in *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals* (EPA 1980). Most of the designated vegetation screening levels are equivalent to or exceed NAAQS and/or PSD increments, so satisfaction of NAAQS and PSD increments assures compliance with sensitive vegetation screening levels. Most of the designated vegetation screening levels are equivalent to or exceed NAAQS and/or PSD increments. The vegetative screening thresholds are reported in Table 3-4 along with the relevant NAAQS for comparison purposes.

TABLE 3-4 VEGETATIVE SCREENING THRESHOLDS

POLLUTANT	AVERAGING PERIOD	SECONDARY NAAQS (µG/M³)	VEGETATIVE SCREENING THRESHOLD (µG/M³)	FORM OF MODELED COMPARISON
NO_2	4-hour	N/A	3760	Maximum 1-hour
	1-Month	N/A	564	Maximum 1-hour
	Annual	100	94	Annual
CO	Week	N/A	1,800,000	Maximum 1-hour
PM_{10}	24-hour	150	N/A	24-hour
$PM_{2.5}$	24-hour	35	N/A	24-hour
	Annual	~~0.49~~15	N/A	Annual

3.4.2 Visibility

Appendix B contains the initial Class I Air Quality Related Values Modeling Report, satisfying the visibility analysis requirements of 40 CFR 52.21(p)(3). The Brigantine Wildlife Refuge Class I area is sufficiently representative of nearby onshore areas that the analysis specific to that Class I area serves to also address the broader visibility analysis per 40 CFR 52.21 (o)(1).

3.4.3 Growth

As described in Volume 1 Section 2.0 of the COP, The Projects will be meaningful contributors to the region's economy by creating thousands of well-paid jobs in the burgeoning renewable energy sector.

The importance of the renewable energy sector in revitalizing the U.S.' economy is exemplified in Presidential Executive Order 14008 (Tackling the Climate Crisis at Home and Abroad), which describes clean energy jobs as a central pillar of the President's Build Back Better and economic recovery plan and directs the Secretary of the Interior to review siting and permitting processes to identify steps to double offshore wind energy production by 2030 (see Section 207; White House 2021). As described in the Executive Order, the construction, manufacturing, engineering, and skilled-trades jobs needed to build a clean energy economy will bring opportunity to communities "that have suffered as a result of economic shifts and places that have suffered the most from persistent pollution, including low-income rural and urban communities, communities of color, and Native communities."

TABLE 3-5 OBSERVED AMBIENT AIR QUALITY CONCENTRATIONS AND SELECTED BACKGROUND LEVELS

Pollutant	Averaging Period	Form	Pollutant Concentration			Units	2019-2021 Background Level (µg/m3)	NAAQS (µg/m3)	Location
			2019	2020	2021				
CO [1]	1-Hour[4]	H2H[5]	2.2	2.3	2.5	ppm	~~2865~~ 2862.5	40000	7 Broad St, Elizabeth, NJ
	8-Hour[4]	H2H	1.90	2	2.3	ppm	~~2635.8~~ 2633.5	10000	
NO_2 [2]	Annual[3]	H[6]	6.31	6.33	6.30	ppb	11.87	100	Millville, NJ
PM_{10}	24-Hour	H2H	34	30	38	$\mu g/m^3$	38	150	Jersey City Firehouse, NJ
$PM_{2.5}$	24-Hour[3]	98th %	14.2	11.2	16.6	$\mu g/m^3$	14.0	35	Brigantine, NJ
	Annual[3]	H	6.03	4.65	6.30	$\mu g/m^3$	5.66	12	

Notes:

From 2019-2020 EPA's AirData Website and NJ DEP Airmon Website (https://www.nj.gov/dep/airmon/, http://www.epa.gov/airquality/airdata)

1 CO reported in ppm. Converted to µg/m3 using factor of 1 ppm = ~~1146~~ 1145 µg/m3.
2 NO2 reported in ppb. Converted to µg/m3 using factor of 1 ppb = 1.88 µg/m3.
3 Background level is the average concentration of the three years.
4 Background level is the maximum concentration of the three years.
5 Background level is based on the highest-second-high value (H2H).
6 Background level is based on the highest value (H).
7 Background level is based on the 98th percentile (98th).

To determine the extent of the significant impact area for a given pollutant, if a pollutant was above the significant impact level, a coarse grid was used to identify the radius of the significant impact area. This was necessary for the following pollutants:

- Construction, 1-hour NO_2
- Construction, ~~24-hr $PM_{2.5}$~~annual NO_2
- Construction, 24-hr $PM_{2.5}$
- Construction, annual $PM_{2.5}$
- Construction, 24-hr PM_{10}
- Construction, 8-hr CO
- O&M, 1-hour NO_2
- O&M, 24-hour $PM_{2.5}$
- O&M, 8-hr CO

4.3.1 Receptor Grid for the Short-Term Air Quality Dispersion Modeling of Construction

For CO, PM_{10}, and $PM_{2.5}$, a cartesian receptor network (Figure 4-8) is centered on the foundation installation associated with an offshore substation (OSS) construction activity. A 500-meter buffer from the edge of vessels involved in each heavy construction activity is used as there will be a safety exclusion zone where access by the public will be limited. Discrete receptors are placed every 25 meters along the boundary of each safety exclusion zone. Beyond the safety exclusion zone, the nested cartesian receptor grid is used with receptor spacing of:

- 20-meter spacing out to 500 meters
- 50-meter spacing from 500 meters to 2,000 meters
- 100-meter spacing from 2,000 meters to 4,000 meters
- 200-meter spacing from 4,000 meters to 10,000 meters

Receptors that fall within the 500-meter safety exclusion zone of a particular construction activity are removed from the analysis. A total of 5,819 receptors are modeled for the short-term form for the CO, PM_{10} and $PM_{2.5}$ NAAQS and PSD Class II increment analyses for construction. For 24-hr PM_{10} and $PM_{2.5}$, the Class I impacts are modeled separately from the NAAQS and PSD Class II Increment runs.

For NO_2, a cartesian receptor network (Figure 4-9) is centered on the foundation installation associated with an offshore substation (OSS) construction activity. A 500-meter buffer from the edge of vessels involved in each heavy construction activity is used as there will be a safety exclusion zone where access by the public will be limited. Around O&M activities a 25-meter buffer from the edge of vessels is used as a safety exclusion zone. Discrete receptors are placed every 25 meters along the boundary of each safety exclusion zone. Beyond the safety exclusion zone, the nested cartesian receptor grid is used with receptor spacing of:

5.0 Air Quality Modeling Results

5.1 Significant Impact Levels

This Section evaluates the impacts against SILs to determine if there could be a "significant impact" on air pollutant concentrations and establish whether a NAAQS or PSD increment modeling analysis is necessary. The significant impact area (SIA) is determined for each pollutant above the PSD increment SIL.

Direct emissions are modeled for comparison to the SILs for NO_x, CO, and PM_{10}. For $PM_{2.5}$, the impacts of both direct $PM_{2.5}$ emissions and $PM_{2.5}$ precursor emissions are addressed. The direct and secondary impacts are added together to compare to the SIL; for impacts are greater than the SIL, a NAAQS and/or PSD increment analysis is completed for $PM_{2.5}$. The results from the SIL analysis appear in Table 5-1, Table 5-2, and Table 5-3 for Construction and Table 5-3, Table 5-4, and 5-5 for O&M.

TABLE 5-1 NAAQS SIGNIFICANT IMPACT LEVEL RESULTS FOR CONSTRUCTION

Poll.	Averaging Time	Form	Max Modeled Conc. (µg/m³)	SIL (µg/m³)	% of SIL	Period	Receptor Location (m)	Significant Impact Area (km)
CO	1-hr	H	1172.4	2,000	59%	6/2/18 Hr: 12	573612.38, 4349025.79, 0.00	N/A
	8-hr	H	679.3	500	136%	4/22/19 Hr:24	573612.38, 4349025.79, 0.00	0.97
NO_2	1-hour	H	214.2	7.5	2856%	2018-2020	568744.20, 4350835.80, 0.00	50
	Annual	H	1.70	1	170%	2019	573481.55, 4351174.65, 0.00	0.5
$PM_{2.5}$	24-hour	H	8.41	1.2	701%	2018-2020	572837.18, 4352800.60, 0.00	50
	Annual	H	0.053	0.2	27%	2018-2020	573481.55, 4351174.65, 0.00	N/A
PM_{10}	24-hour	H	12.6	5	252%	9/14/18 Hr: 24	572837.18, 4352800.60, 0.00	1.7

TABLE 5-2 PSD CLASS II SIGNIFICANT IMPACT LEVEL RESULTS FOR CONSTRUCTION

Poll.	Averaging Time	Form	Max Modeled Construction (µg/m³)	SIL (µg/m³)	% of SIL	Period	Receptor Location (m)	Significant Impact Area (km)
NO_2	Annual	H	1.70	1	170%	2019	573481.55, 4351174.65, 0.00	0.5
$PM_{2.5}$	24-hr	H	12.2	1.2	1015%	9/14/18 Hr:24	572837.18, 4352800.60, 0.00	50
	Annual	H	0.057	0.2	29%	2019	573481.55, 4351175.65, 0.00	N/A
PM_{10}	24-hr	H	12.6	5	252%	9/14/18 Hr: 24	572837.18, 4352800.60, 0.00	1.7
PM_{10}	Annual	H	0.059	1	5.9%	2019	573481.55, 4351174.65, 0.00	N/A

TABLE 5-3 CLASS I SIGNIFICANT IMPACT LEVEL RESULTS FOR CONSTRUCTION

Poll.	Averaging Time	Form	Max Modeled Conc. (µg/m³)	SIL (µg/m³)	% of SIL	Period	Receptor Location (m)
NO_2	Annual	H1H	0.088	0.1	88%	2018	557715.71, 4367392.63, 1.29
$PM_{2.5}$	24-Hour	H1H	0.81	0.27	300%	9/5/18 Hr: 24	556281.77, 4367382.09, 0.48
	Annual	H1H	0.0030	0.05	6%	2018	557715.71, 4367392.63, 1.29
PM_{10}	24-Hour	H1H	0.83	0.3	277%	9/5/18 Hr: 24	556281.77, 4367382.09, 0.48
	Annual	H1H	0.0031	0.2	2%	2018	557715.71, 4367392.63, 1.29

TABLE 5-4 NAAQS SIGNIFICANT IMPACT LEVEL RESULTS FOR O&M

Poll.	Averaging Time	Form	Max Modeled Conc. (µg/m³)	SIL (µg/m³)	% of SIL	Period	Receptor Location (m)	Significant Impact Area (km)
CO	1-hr	H	646.8	2,000	32%	4/9/19 Hr: 05	570917.79, 4358316.05, 0.00	N/A
	8-hr	H	522.2	500	104%	5/9/19 Hr: 08	569681.49, 4358143.22, 0.00	0.025
NO_2	1-hour	H	183.7	7.5	2450%	2018-2020	569688.22, 4358187.44, 0.00	50
	Annual	H	0.61	1	61%	2020	583544.00, 4349179.58, 0.00	N/A
$PM_{2.5}$	24-hour	H	7.88	1.2	656%	2018-2020	571791.17, 4355710.89, 0.00	1.923
	Annual	H	0.021	0.2	11%	2020	583544.00, 4349179.58, 0.00	N/A
PM_{10}	24-hour	H	2.2	5	44%	10/9/18 Hr: 24	569688.22, 4358187.44, 0.00	N/A

TABLE 5-5 PSD CLASS II SIGNIFICANT IMPACT LEVEL RESULTS FOR O&M

Poll.	Averaging Time	Form	Max Modeled Conc. (µg/m³)	SIL (µg/m³)	% of SIL	Period	Receptor Location (m)	Significant Impact Area (km)
NO_2	Annual	H	0.61	1	61%	2020	583544.00, 4349179.58, 0.00	N/A
$PM_{2.5}$	24-hr	H	8.0	1.2	668%	10/7/19 Hr: 24	569715.35, 4358191.96, 0.00	1.923
	Annual	H	0.021	0.2	11%	2020	583544.00, 4349179.58, 0.00	N/A
PM_{10}	24-hr	H	2.2	5	44%	10/9/18 Hr: 24	569688.22, 4358187.44, 0.00	N/A
PM_{10}	Annual	H	0.022	1	2.2%	2020	583544.00, 4349179.58, 0.00	N/A

5.4 Soils and Vegetation

PSD regulations require an analysis of air quality impacts on sensitive vegetation types with significant commercial or recreational value or sensitive types of soil. Evaluation of impacts on sensitive vegetation are performed by comparing the Project's predicted impacts with screening levels presented in A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals (EPA 1980). These procedures specify that predicted impact concentrations used for comparison account for Project impacts and ambient background concentrations.

To determine if the emissions from the Project will adversely impact surrounding vegetation, the modeled concentrations are compared to thresholds found in the screening guidance, as well as to NAAQS secondary standards. The NAAQS secondary standards were designed to protect public property, including crops and vegetation. Therefore, comparing modeled impacts to these thresholds adequately determines if potential impacts are significant. Consistent with available guidance (NSR Draft Workshop Manual, EPA 1990), the analysis includes applicable pollutants that will be emitted by the Project in significant amounts. The vegetative screening thresholds are equivalent to or exceed NAAQS and/or PSD increments so satisfaction of NAAQS and PSD increments assures compliance with sensitive vegetation screening levels.

The vegetative screening thresholds are reported in Table 5-13 along with the relevant NAAQS for comparison purposes. The over-water modeling results, also shown in Table 5-13, indicate that vegetative screening thresholds could not be exceeded,. Therefore, criteria pollutant air emissions from the Project will not negatively impact soils or vegetation.

TABLE 5-13 VEGETATIVE SCREENING THRESHOLDS AND MAXIMUM MODELED CONCENTRATIONS

Pollutant	Averaging Period	Secondary NAAQS (µg/m^3)	Vegetative Screening Threshold (µg/m^3)	2019-2021 Background Level (µg/m^3)	Maximum Modeled Concentration (µg/m^3)	Form of Modeled Comparison
NO_2	4-hour	N/A	3,760	63.4	214.2	Maximum 1-hour
	1-Month	N/A	564	63.4	214.2	Maximum 1-hour
	Annual	100	94	11.87	1.70	Annual
CO	Week	N/A	1,800,000	2,865	1172.4	Maximum 1-hour
PM_{10}	24-hour	150	N/A	38	12.6	24-hour
$PM_{2.5}$	24-hour	35	N/A	14.0	8.41	24-hour
	Annual	~~0.49~~15	N/A	5.66	0.053	Annual

ATTACHMENT B

Group	Activity	Representative Vessel Type	Will it be an OCS Source?	Representative Vessel Flag	Representative Engine Information
FOU Install	Medium HLV	Heavy Lift Vessel	No	Foreign	4 x 3,840kW 2 x 4,800kW 1 x 1,110kW
FOU Install	Bubble Curtain Support Vessel	Tug	No	Foreign	2 x 5,530kW
FOU Install	Barges	Barge	No	US	1 x 50kW
FOU Install	US Towing Tugs	US Towing Tug	No	US	2 x 2,525 kW 3 x 79 kW
FOU Install	Crew Transfer / PSO / Noise Monitoring Vessel	Crew Transfer Vessel	No	Foreign/US	4 x 522kW 2 x 27kW
FOU Install	Bubble Curtain Power	Air Compressor	No	N/A	20 x 399kW
FOU Install	Hydraulic Hammer Power	Hydraulic Hammer Engine	No	N/A	3 x 597kW
OSS Install	Medium HLV	Heavy Lift Vessel	No	Foreign	4 x 3,840kW 2 x 4,800kW 1 x 1,110kW
OSS Install	Bubble Curtain Support Vessel	Tug	No	Foreign	2 x 5,530kW
OSS Install	Transport Barges	Barge	No	US	1 x 50kW
OSS Install	US Towing Tugs	US Towing Tug	No	US	2 x 2,525 kW 3 x 79 kW
OSS Install	Crew Transfer Vessel	Crew Transfer Vessel	No	Foreign	4 x 522kW 2 x 27kW
OSS Install	Bubble Curtain Power	Air Compressor	No	N/A	20 x 399kW
OSS Install	Hydraulic Hammer Power	Hydraulic Hammer Engine	No	N/A	3 x 597kW
Scour Protection	Fall Pipe Vessel	Fall Pipe Vessel	No	Foreign	4 x 3,350kW 4 x 2,000kW 1 x 2,950kW
Scour Protection	US Dredger	US Dredger	No	US	2 x 641kW 1 x 954kW
IAC Install	Cable Installation Vessel	Cable Installation Vessel	No	Foreign	1 x 7,280kW 1 x 220kW
IAC Install	Cable Installation Support Activities	Support Vessel/SOV	No	Foreign	4 x 1,200kW 1 x 800kW
IAC Install	Sand Wave Clearance	TSHD (Dredger)	No	US	2 x 641kW 1 x 954kW
IAC Install	Pre Lay Grapnel Run AHTS 1	AHTS	No	Foreign	2 x 4,500kW 2 x 410kW
IAC Install	Pre Lay Grapnel Run AHTS 2	AHTS	No	Foreign	2 x 4,500kW 2 x 410kW
IAC Install	Post-Install Rock Protection	Rock Dumping Vessel (Fall Pipe Vessel)	No	Foreign	4 x 3,350kW 4 x 2,000kW 1 x 2,950kW

ATTACHMENT B

Group	Activity	Representative Vessel Type	Will it be an OCS Source?	Representative Vessel Flag	Representative Engine Information
WTG Install	WTG Installation Vessel	Jackup Vessel	Yes	Foreign	4 x 3,535kW 4 x 2,650kW
WTG Install	US Jack Up Feeders	Jack up	Yes	US	3 x 2,500kW
WTG Install	Crew Transfer	Crew Transfer Vessel	No	Foreign/US	4 x 522kW 2 x 27kW
WTG Install	WTG Commissioning SOV	Service Operation Vessel	No	Foreign	4 x 1,200kW 1 x 800kW
Export Cable Install	Cable Installation Vessels	Cable Installation Vessel	No	Foreign	2 x 2,560kW 2 x 1,913kW 2 x 1,400kW
Export Cable Install	Support and Jointing Vessel	Support Vessel	No	Foreign	2 x 2,350kW 1 x 1,786kW 2 x 994kW
Export Cable Install	TSHD	Dredger	No	US	2 x 641kW 1 x 954kW
Export Cable Install	AHTS	Tug	No	Foreign	2 x 4,500kW 2 x 410kW
Export Cable Install	Post-Install Rock Protection	Rock Dumping Vessel (Fall Pipe Vessel)	No	Foreign	4 x 3,350kW 4 x 2,000kW 1 x 2,950kW
Fuel Bunkering	Towing Tug	Tug	No	US	2 x 2,525 kW 3 x 79 kW
Fuel Bunkering	Barge	Barge	No	US	1 x 50kW
Fuel Bunkering	Motion Compensation	Motion Compensation	No	N/A	1 x 500kW
Commissioning Generators	OSS Commissioning Generators	Generator	Yes	N/A	8 x 500kW
Commissioning Generators	WTG Commissioning Generators	Generator	Maybe	N/A	1 x 240kW

ATTACHMENT B

Group	Activity	Representative Vessel Type	Will it be an OCS Source?	Vessel Flag	Engine Information
WTG and BoP Crew logistics	Crew Transfer Vessels	Crew Transfer Vessel	No	Foreign/US	4 x 522kW 2 x 27kW
WTG and BoP Crew logistics	Service Operation Vessel	Service Operation Vessel	No	Foreign/US	4 x 2,306kW 2 x 27kW
WTG and BoP Crew logistics	SOV Daughter Craft	Crew Transfer Vessel	No	Foreign/US	4 x 522kW 2 x 27kW
WTG heavy logistics / jack-up	US Jackup Vessel	Jackup Vessel	Yes	US	6 x 4,000kW
WTG heavy logistics / jack-up	US Feeder Vessel	Jackup Vessel	Yes	US	2 x 2,350kW 2 x 1,000kW
WTG heavy logistics / jack-up	European Jackup Vessel	Jackup Vessel	Yes	Foreign	6 x 4,000kW
Export and Array Cable Repair	Cable Repair Vessel	Cable Lay Vessel	No	Foreign	1 x 7,280kW 1 x 220kW
Export and Array Cable Survey	Cable survey vessel	Survey Vessel	No	US	2 x 1,900kW 2 x 99kW
Subsea Inspection	Vessel for subsea inspection	Survey Vessel	No	US	2 x 1,900kW 2 x 99kW
Other Vessels	Environmental monitoring vessel	Crew Transfer Vessel	No	Foreign	4 x 522kW 2 x 27kW
Other Vessels	SOV campaign (e.g., for retrofit campaign)	Service Operation Vessel	No	Foreign	4 x 2,306kW 2 x 27kW
Other Vessels	OSS repair vessel (major repair)	Jack-Up Vessel	Yes	Foreign	6 x 4,000kW
Commissioning Generators	OSS Commissioning Generators	Generator	Yes	N/A	8 x 500kW

Atlantic Shores South OCS Emission Factors Sources and Explanation

- Marine Vessel Engines:
    - Emission Factors for EF Ref# 1M-11A (first 22 rows of factors) for NOx, VOC, CO, PM10, PM2.5, SO2, Pb, CO2, CH4, and N2O are from BOEM Wind Tool Version 1 (Bureau of Ocean Energy Management. 2017. BOEM Offshore Wind Energy Facilities Emission Estimating Tool v1.)
    - Emission Factors for EF Ref# 1M-11A (first 22 rows of factors) for HAP are calculated using NEI data from Environmental Protection Agency. April 2020, revised January 2021. 2017 NEI Development Documentation - Methodology Documentation for EPA's Commercial Marine Emissions Estimates. https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data which are represented as a multiplier to PM10 and VOC emissions that represents the fraction of PM10 and VOC that are HAPs.
- Helicopters:
    - Emission Factors for EF Ref# 12-15 (representing helicopters) for NOx, VOC, CO, PM10, PM2.5, SO2, Pb, CO2, CH4, and N2O are from BOEM Wind Tool Version 1 (Bureau of Ocean Energy Management. 2017. BOEM Offshore Wind Energy Facilities Emission Estimating Tool v1.)
        - Note that there are no helicopters assumed in the calculations for the OCS Air Permitting effort since it was more conservative to assume crew transfer vessels instead of helicopters.
- Non-Road Engines:
    - Emission factors for Non-Road Engines (EF Ref# 16-27 and 30-32) for NOx, VOC, CO, PM10, and PM2.5 are from 40 CFR 60 Subpart IIII which points to 40 CFR 1039 for engine standards. These line items represent the appropriate tier engine from the 40 CFR 1039 tables.
        - Where standards are provided as NOx + NMHC, 100% of the standard is assumed as NOx to be conservative and 12% of the standard is assumed as VOC based on the break out of VOC vs NOx for other tier standards where they are distinct values.
    - Emission factors for Non-Road Engines (EF Ref# 16-27 and 30-32) for SO2 are based on USLD requirement for 0.0015% fuel sulfur, an assumed fuel density of 7 lb/gal, the molecular weight ratio of 2:1, and a fuel heat content of approximately 140,000 btu/gallon
    - Emission factors for Non-Road Engines (EF Ref# 16-27 and 30-32) for CO2, CH4, and N2O are based on 40 CFR 98 Tables C-1 and C-2 and an assumed 10,000 Btu/kW engine efficiency.
    - Emission factors for Non-Road Engines (EF Ref# 16-27 and 30-32) for HAPs and Lead are based on relevant AP-42 standards converted to g/kWh units based on an assumed 10,000 Btu/kW.
        - Relevant AP-42 standards for large engines are from Chapter 3.4
        - Relevant AP-42 standards for smaller engines are from Chapter 3.3

- Commuting Emissions (EF Ref 28-29):
    - NOx, VOC, CO, PM10, and PM2.5 emission factors are from Table 4-43 "Estimated U.S. Average Vehicle emissions Rates per Vehicle by Vehicle Type Using Gasoline and Diesel" from the Bureau of Transportation Statistics as found at the following link. The values used were based on the newest report which at the time of emissions calculation generation was dated 2021. https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and
    - SO2 emissions are based on the fuel sulfur content of gasoline per an EPA document found here: https://www.epa.gov/gasoline-standards/gasoline-sulfur#:~:text=The%20program%20sets%20new%20vehicle,and%20some%20heavy%2Dduty%20vehicles
        - Additionally assumes that gasoline is assumed to have a density of 6.17 lb/gal, SO2 to sulfur molecular weight ratio is 2.0, and the fleetwide average miles per gallon is 22.3.
    - GHG emissions (CO2, CH4, and N2O) are based on 40 CFR 98 Tables C-1 and C-2 and the fleetwide average miles per gallon of 22.3.
    - The SO2 and GHG emissions are based on a fleetwide average of 22.3 miles per gallon per Table 4-23M "Average Fuel Efficiency of U.S. Passenger Cars and Light Trucks" found here: https://www.bts.gov/content/average-fuel-efficiency-us-passenger-cars-and-light-trucks
- Load Factors
    - Load factors for main engines of 0.83 (83 percent) is from EPA's Current Methodologies in Preparing Port Emission Inventories (2009) Section 2.5
    - Load factors for main engines maneuvering or hoteling are from BOEM Wind Tool Version 1.
    - Load Factors for Auxiliary Engines on Vessels w/ Cat. 3 Main Engines are from Table 4-120 of EPA's 2014 National Emissions Inventory, version 2 Technical Support Document (July 2018) found here: https://www.epa.gov/sites/default/files/2018-07/documents/nei2014v2_tsd_05jul2018.pdf
    - Load Factors for Auxiliary Engines on Vessels w/ Category 1 and 2 main engines are from Table 4 of Eastern Research Group's 2019 document titled "Category 1 and 2 Commercial Marine Vessel 2017 Emissions Inventory."
    - The additional table with Load Factors for Auxiliary Engines on Vessels w/ Cat. 3 Main Engines are from EPA's Current Methodologies in Preparing Port Emission Inventories (2009) and Table 4-17 of EPA's 2015 document titled "Commercial Marine Vessels – 2014 NEI Commercial Marine Vessels Final."

- Fuel Use Factors
  - Fuel use factors for slow-speed diesel, medium-speed diesel, and medium-speed diesel auxiliary engines firing marine diesel oil are from Table 2-9 and Table 2-16 of EPA's Current Methodologies in Preparing Port Emission Inventories (2009)
  - Fuel use factors for Category 1 and 2 main and auxiliary engines are calculated based on:
    - CO2 emission factor from the BOEM Offshore Wind Energy Facilities Emission Estimating Tool Technical Documentation Table 3
    - Diesel fuel density of 7.1 lb/gal per Table 3.4-1 of AP-42 Chapter 3.4
    - Diesel fuel higher heating value of 0.138 MMBtu/gal per 40 CFR 98 Table C-1.
- Global Warming Potentials GHG pollutants are from Table A-1 of 40 CFR 98
- Port Distances and export cable lengths and OCS percentages are provided by Atlantic Shores and/or measured using GIS tools.

BOEM Emissions Tool Default Vessel Emissions Factors

EF Ref	Vessel Type	Engine type	Emission Factors (g/kWh)										
			NOx	VOC	CO	PM10	PM2.5	SO2	Pb	HAPs	CO2	CH4	N2O
1M	Anchor Handling Tugs	Main	9.26	0.24	2.16	0.34	0.33	0.079	4.0E-05	0.033	636.09	0.004	0.031
1A		Auxiliary	9.88	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
2M	Barge	Main	13.61	0.63	1.40	0.45	0.42	0.362	1.2E-05	0.078	588.90	0.004	0.031
2A		Auxiliary	12.57	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
3M	Cable Laying	Main	9.49	0.25	2.20	0.34	0.33	0.085	3.9E-05	0.034	635.02	0.004	0.031
3A		Auxiliary	9.89	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
4M	Crew	Main	9.15	0.14	2.30	0.31	0.30	0.006	4.6E-05	0.022	648.16	0.004	0.031
4A		Auxiliary	10.39	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
5M	Dredging	Main	9.60	0.28	2.13	0.36	0.34	0.112	3.7E-05	0.038	630.62	0.004	0.031
5A		Auxiliary	9.85	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
6M	Ice Breaker	Main	9.92	0.45	1.78	0.40	0.38	0.230	2.5E-05	0.057	610.83	0.004	0.031
6A		Auxiliary	10.09	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
7M	Jackup	Main	10.03	0.14	2.30	0.31	0.30	0.013	4.5E-05	0.022	647.08	0.004	0.031
7A		Auxiliary	11.55	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
8M	Research / Survey	Main	9.86	0.22	2.25	0.34	0.33	0.066	4.2E-05	0.031	638.26	0.004	0.031
8A		Auxiliary	10.21	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
9M	Shuttle Tanker	Main	9.05	0.63	1.40	0.45	0.42	0.362	1.2E-05	0.078	588.90	0.004	0.031
9A		Auxiliary	9.80	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
10M	Supply Ship	Main	9.44	0.17	2.29	0.32	0.31	0.028	4.5E-05	0.025	644.58	0.004	0.031
10A		Auxiliary	10.43	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031
11M	Tug	Main	9.52	0.18	2.29	0.33	0.32	0.033	4.5E-05	0.026	643.66	0.004	0.031
11A		Auxiliary	10.10	0.14	2.48	0.32	0.31	0.006	4.8E-05	0.022	648.20	0.004	0.031

BOEM Emissions Tool Default Helicopter Emissions Factors

EF Ref	Engine	Size (kW)	Emission Factors (lb/hr)										
			NOx	VOC	CO	PM10	PM2.5	SO2	Pb	HAPs	CO2	CH4	N2O
12	Helicopter	Single	2.32	1.63	1.89	0.07	0.07	0.300	0.0E+00	N/A	956.92	0.030	0.030
13	Helicopter	Twin Light	3.14	3.66	4.28	0.10	0.09	0.500	0.0E+00	N/A	1589.69	0.040	0.050
14	Helicopter	Twin Medium	7.22	3.02	3.48	0.20	0.20	0.780	0.0E+00	N/A	2459.92	0.070	0.080
15	Helicopter	Twin heavy	34.66	2.40	2.67	0.82	0.80	2.110	0.0E+00	N/A	6640.46	0.190	0.220

Load Factors for Main Engines

Vessel/Engine	Activity	Load Factor
Cat. 3 Main (Propulsion) Engine	Transit/cruise	0.83
Cat. 3 Main (Propulsion) Engine	Maneuvering	0.2
Cat. 3 Main (Propulsion) Engine	Hoteling	0
Cat. 1/2 Main (Propulsion) Engine	Transit/cruise	0.83
Cat. 1/2 Main (Propulsion) Engine	Maneuvering	0.2
Cat. 1/2 Main (Propulsion) Engine	Hoteling	0

Load Factors for Auxiliary Engines on Vessels w/ Cat. 3 Main Engines

Vessel Type	Maneuver	Hotel
Bulk Carrier	0.45	0.1
Bulk Carrier, Laker	0.45	0.22
Buoy Tender	0.45	0.19
Container	0.48	0.26
Crude Oil Tanker	0.33	0.22
Drilling	0.45	0.22
Fishing	0.45	0.22
Floating Production and Storage Offloading	0.45	0.22
General Cargo	0.45	0.22
Icebreaker	0.45	0.22
Jackup	0.45	0.22
LNG Tanker	0.33	0.26
LPG Tanker	0.33	0.26
Misc.	0.45	0.22
Passenger	0.8	0.64
Pipelaying	0.45	0.22
Reefer	0.67	0.32
Research	0.45	0.22
RORO	0.45	0.26
Supply	0.45	0.22
Support	0.45	0.22
Tanker	0.33	0.26
Tug	0.45	0.22
Vehicle Carrier	0.45	0.22
Well stimulation	0.45	0.22

Table 4-120 of https://www.epa.gov/sites/production/files/2018-07/documents/nei2014v2_tsd_05jul2018.pdf

Emissions Factors for Engines

EF Ref	Engine	Size (kW)	Emission Factors (g/kWh)										
			NOx[1]	VOC[2]	CO	PM10	PM2.5	SO2[3]	Pb	HAPs[5]	CO2[4]	CH4[4]	N2O[4]
16	Air Compressor Engines	~399	2	0.19	3.5	0.025	0.025	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
17	Motion Compensation Engines	500	4	0.495	3.5	0.2	0.2	0.0068	0.00E+00	7.14E-03	739.60	0.030	0.0060
18	Cat C18 Acert	597	6.4	0.8	3.5	0.2	0.2	0.0068	0.00E+00	7.14E-03	739.60	0.030	0.0060
19	Tier 2 Engines 0-8 kW	0-8	7.5	0.929	8	0.8	0.8	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
20	Tier 2 Engines 8-19 kW	8-19	7.5	0.929	6.6	0.8	0.8	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
21	Tier 2 Engines 19-37 kW	19-37	7.5	0.929	5.5	0.6	0.6	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
22	Tier 3 Engines 37-75 kW	37-75	4.7	0.582	5	0.4	0.4	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
23	Tier 3 Engines 75-130 kW	75-130	4	0.495	5	0.3	0.3	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
24	Tier 3 Engines 130-225 kW	130-225	4	0.495	3.5	0.2	0.2	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
25	Tier 3 Engines 225-450 kW	225-450	4	0.495	3.5	0.2	0.2	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
26	Tier 3 Engines 450-560 kW	450-560	4	0.495	3.5	0.2	0.2	0.0068	0.00E+00	7.14E-03	739.60	0.030	0.0060
27	Tier 2 Engines >560 kW	>560	6.4	0.792	3.5	0.2	0.2	0.0068	0.00E+00	7.14E-03	739.60	0.030	0.0060
30	Tier 4 Engine 130-560 kW	130-560	0.67	0.19	3.5	0.02	0.02	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
31	OSS Commissioning Generator	500 kW	5.80	0.70	5.00	0.10	0.10	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060
32	WTG Commissioning Generator	240 kW	5.40	0.65	5.00	0.12	0.12	0.0068	0.00E+00	1.76E-02	739.60	0.030	0.0060

1 NOx emission values are assumed to be 100% of the relevant tier standard for NOx+NMHC if no separate NOx standard

2 VOC emission values are assumed to be 12% of the relevant tier standard for NOx+NMHC if no separate VOC/NMHC standard

3 Based on ULSD Fuel Sulfur of 0.0015%, fuel density of ~7lb/gal, fuel heat content of ~0.14 MMBtu/gal, and SO2:Sulfur ratio of 2.0

4 Based on GHG emissions and heat content of ULSD from 40 CFR 98 Tables C-1 and C-2 and an assumed engine efficiency of 10,000 Btu/kW

5 HAP Emission Factors are in lb/MMBtu in AP-42 and converted to g/kwH based on an assumed 10,000 btu/kW

Commuting Emissions

EF Ref	Engine	Fuel	Emission Factors (g/VMT)										
			NOx[1]	VOC[1]	CO[1]	PM10[1]	PM2.5[1]	SO2[2]	Pb	HAPs	CO2[3]	CH4[3]	N2O[3]
28	Light-duty vehicles	Gasoline	0.289	0.35	3.94	0.012	0.012	0.0025	0.00E+00	N/A	393.61	0.017	0.0034
29	Light-duty trucks	Gasoline	0.478	0.421	5.66	0.014	0.014	0.0025	0.00E+00	N/A	393.61	0.017	0.0034

1 2018 values from Table 4-43 "Estimated U.S. Average Vehicle emissions Rates per Vehicle by Vehicle Type Using Gasoline and Diesel" at https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and

2 Based on 10 ppm sulfur in gasoline, 6.17 lb/gal density, fleet average of 22.3 mpg, and SO2 to Sulfur weight ratio of 2.

3 Based on GHG emissions and heat content of motor gasoline from 40 CFR 98 Tables C-1 and C-2 and fleet average of 22.3 mpg

4 Fleet average MPG is from Table 4-23M from Bureau of Transportation Statistics found here: https://www.bts.gov/content/average-fuel-efficiency-us-passenger-cars-and-light-trucks

Load Factors for Auxiliary Engines on Vessels w/ Cat. 1 & 2 Main

Vessel Group	Auxiliary Operating Load Factor
Bulk Carrier	0.1
Commercial Fishing	0.43
Container Ship	0.19
Ferry Excursion	0.43
General Cargo	0.22
Government	0.43
Miscellaneous	0.43
Offshore support	0.56
Reefer	0.32
RORO	0.26
Tanker	0.26
Tug	0.43
Work Boat	0.43

Eastern Research Group. 2019. Category 1 and 2 Commercial Marine Vessel 2017 Emissions Inventory (2019). Table 4. Auxiliary and Boiler Power Surrogates.

Load Factors for Auxiliary Engines on Vessels w/ Cat. 3 Main Engines

EPA Vessel Type (NEI Vessel Types)	Cruise	RSZ	Maneuver
Auto Carrier	0.15	0.3	0.45
Bulk Carrier	0.17	0.27	0.45
Container Ship	0.13	0.25	0.48
Cruise Ship (Passenger)	0.8	0.8	0.8
General Cargo (Supply, Vehicle Carrier)	0.17	0.27	0.45
Miscellaneous (Buoy Tender, Drilling, Fishing, FPSO, Icebreaker, Jackup, Miscellaneous, Pipelaying, Research, Support, Well Stimulation)	0.17	0.27	0.45
OG Tug (Tug)	0.17	0.27	0.45
Reefer	0.2	0.34	0.67
RORO	0.15	0.3	0.45
Tanker (LNG Tanker, LPG Tanker, Crude Oil Tanker)	0.24	0.28	0.33

Sources:

EPA. 2009. Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories: Final

EPA. 2015. Commercial Marine Vessels – 2014 NEI Commercial Marine Vessels Final. Table 4-17: Auxiliary

Fuel Use Factors		
Engine Type	**Fuel Use (g/kWh)**	**Fuel Use (gal/kWh)**
Slow-speed Diesel, Marine Diesel Oil[1]	185	0.057
Medium-speed Diesel, Marine Diesel Oil[1]	205	0.064
Medium-speed Diesel, Marine Diesel Oil Auxiliary[1]	217	0.067
Cat. 1 & 2 (main and auxiliary)[2]	N/A	0.064

1 From "Current Methodologies and Best Practices in Preparing Port Emission Inventories" April 2009, Table 2-9: Emission Factors for OGV Main Engines, Table 2-16: Auxiliary Engine Emission Factors
2 Calculated from BOEM CO2 emission rate for Cat. 1 & 2 Marine Engines below

Fuel Use Calculations	
Diesel Fuel Density (lb/gal)[1]	7.10
Distillate Fuel No. 2 Higher Heating Value (MMBtu/gal)[2]	0.138
Distillate Fuel No. 2 CO2 Emission Factor (kg CO2/MMBtu)[2]	73.96
Cat. 1 & 2 Main Engine CO2 Emission Factor (g/kW*hr)[3]	648.20
Cat. 1 & 2 (main and auxiliary)) fuel use (gal/kWh)	0.064

1 From Table 3.4-1 AP 42
2 From 40 CFR Part 98 Table C-1: Default CO2 Emission Factors and High Heat Values for Various Types of Fuel
3 From BOEM Offshore Wind Energy Facilities Emission Estimating Tool Technical Documentation Table 3: Weighted Marine Vessel Emission Factors

Global Warming Potentials[1]	
Compound	**GWP**
CH4	25
N2O	298

1 Table A-1 of 40 CFR 98

Overall Port Distance			
Port Name	**Lookup**	**Port Distance (Mi)**	**Port Distance (NM)**
Atlantic City	Atlantic City	20	17
New Jersey Wind Port	NJWP	105	91
Europe	Europe	288	250
Paulsboro	Paulsboro	145	126

Overall Port Distance in OCS Applicability Zone			
Port Name	**Lookup**	**Port Distance (Mi)**	**Port Distance (NM)**
Atlantic City	Atlantic City	20	17
New Jersey Wind Port	NJWP	29	25
Europe	Europe	29	25
Paulsboro	Paulsboro	29	25

Max Export Cable Included in OCS Area	51%	
measured export cable length max in OCS area	37.74	miles
measured export cable length max	73.86	miles
North Export Cable OCS	29.19	miles
North Export Cable Total	61.86	miles
South Export Cable OCS	8.55	miles
South Export Cable Total	12	miles

Attachment 11:

Supplemental Information Provided by Atlantic Shores to EPA on September 3, 2024, and Requested by EPA Based on Public Comments Received

Coast Star Letter

- If the referenced Harvard study published in the journal Joule is “Climatic Impacts of Wind Power” (https://doi.org/10.1016/j.joule.2018.09.009), this research was specific to onshore wind projects and did not include offshore wind power within its scope. The conclusions may not be applicable to offshore wind projects including the Atlantic Shores South Projects.

Objections Sent to Public Hearing Aug 16 2024

- Comment 1: On Proximity to Shore
    - The assertion that the proposed Projects will be constructed less than 8 miles from shore does not accurately reflect the proposed location of the Projects. As stated in the COP, at its closest point, the Wind Turbine Area is approximately 8.7 miles (mi) (14 kilometers [km]) from the New Jersey shoreline.

    - Although the proposed Projects will be visible from shore at certain times, this visibility will often be limited due to atmospheric conditions. In fact, the FEIS concludes that at the closest analyzed Key Observation Point (KOP), turbines would only be visible for approximately half of the year. Further discussion on the visibility of the Projects can be found in the FEIS and in Section 5.0 of Volume II of the Atlantic Shores Offshore Wind Construction and Operations Plan (COP), including proposed environmental protection measures to effectively reduce the potential visual impacts as practicable given the nature of the technology and the location of the Projects. The full Visual Impact Assessment is included as Appendix II-M1 of the COP. The COP and its appendices are publicly available on the Bureau of Ocean Energy Management’s website.

Borough of Seaside Park Letter

- Comment 1: turbine visibility from shore
    - Although the proposed Projects will be visible from shore at certain times, this visibility will often be limited due to atmospheric conditions. In fact, the FEIS concludes that at the closest analyzed Key Observation Point (KOP), turbines would only be visible for approximately half of the year. Further discussion on the visibility of the Projects can be found in the FEIS and in Section 5.0 of Volume II of the Atlantic Shores Offshore Wind Construction and Operations Plan (COP), including proposed environmental protection measures to effectively reduce the potential visual impacts as practicable given the nature of the technology and the location of the Projects. The full Visual Impact Assessment is included as Appendix II-M1 of the COP. The COP and its appendices are publicly available on the Bureau of Ocean Energy Management’s website.
- Comment 5: global warming impacts
    - Table 3-3 of the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application shows the Projects’ expected avoided emissions, which are calculated using the latest-available output emission rate for the Reliability First Corporation (RFC) East

subregion as published by the EPA. The rest of Section 3.9.3 goes on to explain why these calculated avoided emissions actually underestimate the air-quality related benefits of the Projects.

  - The comment's excerpted quotation from the Harvard researcher goes on to state that "The direct climate impacts of wind power are instant, while the benefits of reduced emissions accumulate slowly… If your perspective is the next 10 years, wind power actually has — in some respects — more climate impact than coal or gas. If your perspective is the next thousand years, then wind power has enormously less climatic impact than coal or gas... The work should not be seen as a fundamental critique of wind power." The same researcher also claims that "Wind beats coal by any environmental measure, but that doesn't mean that its impacts are negligible." The two publications mentioned in the article from which the quotation was excerpted are limited in scope to onshore wind.

SaveLBI Comment Letter

The NJ Regional Haze State Implementation Plan (SIP)

- Table 2.3 of the New Jersey Regional Haze SIP (https://dep.nj.gov/airplanning/state-implementation-plans-sips/regional-haze-sip-2020/) indicates that the uniform annual rate of improvement required to achieve natural visibility (for the 20% most impaired days) by 2064 is 0.28 deciviews. This rate is based on the Uniform Rate of Progress (URP), also known as the glide path. The 0.28 deciview benchmark is not an annual requirement but rather a standard for evaluating progress against the Reasonable Progress Goal (RPG).

- Figure 2-2 of the New Jersey Regional Haze SIP shows that the projected 2028 visibility at the Brigantine Wilderness Area is well below the URP level. Additionally, the figure indicates that the observed 2016 visibility at Brigantine is approximately 6 deciviews below the URP glide path. The average observed visibility from 2018-2022 (see figure below) shows more than 6 deciviews below the URP glide path. Therefore, any potential increases in visibility degradation at Brigantine due to the project would not endanger Brigantine's visibility remaining below the URP glide path and meeting the regional haze rule goals.

2.5 Uniform Rate of Progress

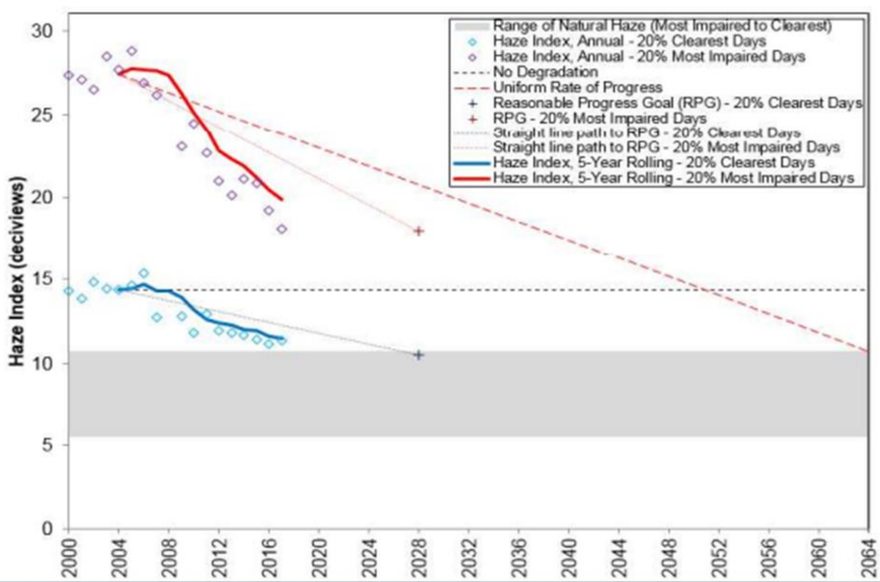
The uniform rate of progress (URP) defines, in deciviews per year, the rate of visibility improvement that would be maintained to attain natural visibility conditions by the end of 2064. The URP or glide path is represented in Figure 2-2 as a straight line between baseline conditions and 2064. DEP's calculations using most impaired days show the URP to be 0.28 deciviews per year. See Table 2-3. As seen in Figure 2-2, the reasonable progress goals established for 2028 at the Brigantine Wilderness Area are expected to provide visibility improvements at a greater rate than this rate.

Table 2-3: Uniform Rate of Progress for Brigantine Wilderness Area

2000–2004 Baseline Visibility (20% Most Impaired)	2064 Natural Visibility (20% Most Impaired Days)	Total Improvement Needed by 2028	Total Improvement Needed by 2064	Uniform Annual Rate of Improvement
27.43	10.69	6.72	16.74	0.28

The calculated URP line is drawn for the most impaired visibility days only. USEPA recommended in its draft guidance that states recalculate the value of the 2000–2004 baseline, or use an updated value provided by USEPA or the IMPROVE program. Figure 2-2 shows that Brigantine Wilderness Area is well below the 2018 URP level for the first SIP Planning period and currently below the 2028 URP level for the second planning period.

Figure 2-2: Visibility Metrics levels at Brigantine Wilderness Area



1. Project Segmentation and Conflicting Descriptions and Schedules

- Atlantic Shores is proposing to construct up to 200 WTGs. The peak year emissions accounts for 141 turbine installations, reflecting the highest possible amount of activity that may occur in one year based on the schedule presented in the Air Permit Application. For modeling purposes, Atlantic Shores assumed this level of emissions would occur for *all three years*. Thus, there is no artificial segmenting of the project.

2. Unrealistic and Realistic Foundation Installation Rates.

- When calculating the total length of the construction period, the duration of WTG installation does not need to be added to the duration of foundation installation at each individual location. This is because one vessel can install a foundation at one location while a different vessel installs a WTG in another location where the foundation has already been constructed.

3. Ignoring Real World Monthly Constraints on Pile Driving

- The air quality dispersion modeling for the short-term $PM_{2.5}$ NAAQS and PSD Increment considers continuous operation over each entire day, over the course of an entire year; including nighttime periods. This is despite the seasonal restrictions on pile driving, and thus, it is highly conservative.
- The AERMOD model appropriately fulfills regulatory standards for CAA permits. Emissions used in the AERMOD modeling represent peak hour emissions. This is shown by the column labels on the model inputs in Appendix B to the Air Quality Dispersion Modeling Report, which is itself Appendix C to the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application. Peak emissions were calculated using the methodology described in Section 2.2 of the Outer Continental Shelf Air Permit Application, which reflects that the model assumes the peak hour emission rate for the whole 24-hour day for short-term modeling.

4. Improper Averaging of Modeled Concentrations & Likely PSD Increment Exceedance.

- The forms of the $PM_{2.5}$ 24-hour NAAQS and $PM_{2.5}$ 24-hour Increment are different from each other. These are described in Table 3-1 and Table 3-2 respectively.
  - The $PM_{2.5}$ 24-hour NAAQS is the 98th percentile concentration averaged over three years,
  - The $PM_{2.5}$ 24-hour PSD Class I increment is the 24-hour maximum, not to be exceeded more than once per year.
- The different averaging times (short-term or annual) of the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) Increments are represented differently in the air dispersion modeling performed for the Atlantic Shores Projects. These are described in Section 4.2 of the Air Quality Dispersion Modeling Report, which is Appendix C of the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application.
  - The annual emissions analysis and the 24-hour analysis of $PM_{2.5}$ are independent from each other and performed differently.
    - The short-term 24-hour analysis uses the peak hour emissions from the model inputs table for each source.
    - The annual analysis includes the worst-case year’s predicted hours per year of operation for each source.
  - This is demonstrated in Appendix B to the Air Quality Modeling Report (Appendix C to the Air Plan Application).

- For comparison with the $PM_{2.5}$ annual NAAQS and PSD Increments, the project is modeled assuming continuous emissions at the 141 nearest-to-shore wind turbine generator (WTG) locations over a three-year period, which reflects an overestimation of impacts instead of truncating the project.

- The air quality dispersion modeling for the short-term $PM_{2.5}$ NAAQS and Increment were modeled assuming construction activities occurred at and around a single WTG location, continuously for a 3-year meteorological period, and as a result, it is highly conservative. The modeling results do not reflect an average of a single year of construction followed by two years of no construction emissions.

5. Underestimated Daily Construction Emissions

- The hours of pile driving per day do not impact the short-term emissions since the emissions presented for short-term durations represent peak hour emissions occurring continuously over the 3-year modeled period.

6. Improper Averaging of Daily Emissions.

- For all construction activities, short-term model input emission rates, in units of grams per second, were generated for the peak hour and assumed to run 24 hours per day for all short-term model runs, which is a conservative approach.

7. Failure to Consider Night Time pile driving

- See response 3.

8. Monthly Installation schedules

- See response 3, 5 and 6.

9. Unclear Emission sources.

- The emissions and source parameters for short-term modeling of Construction can be found in Appendix B of the Air Quality Dispersion Modeling Report.
- Operations and Maintenance Emissions are described in Section 4.2 of the Air Quality Dispersion Modeling Report. The emission rates and source parameters modeled are in Appendix B of the Air Quality Dispersion Modeling Report.
- The calculations in Appendix B to the Air Permit Application contain tables which show the individual activity groups, such as Foundation Installation or WTG Installation, associated with Construction and Operations phases of the project. These calculations also show details of the individual vessels within each activity group, including the vessel engine count, vessel engine size, home port, trip count, trip distance, operating days in the Wind Turbine Area, engine load factor for each engine type and activity, and emissions factors used in determining the peak hour emission rate that feed into the application and the short-term modeling. Similar

information is also located in Appendix B of the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application.

10. Modeling Distances

- [these can be determined from the modeling files but are not explicitly stated in the application. EPA can choose whether to calculate and include]

11. Non-Representative Meteorological Conditions.

- The three years of meteorological data used for the Air Quality Dispersion Modeling analysis are described in Section 4.5 of the Air Dispersion Modeling Report. The project used prognostic data. The prognostic data is reflective of overwater meteorological conditions in the vicinity of the Projects. The representative analysis demonstrating the representativeness of the prognostic data can be found in Appendix E of the Air Quality Dispersion Modeling Report.

12. Foundation Size

- See 5.

13. The Annual Average PM 2.5 concentration.

- The forms of the $PM_{2.5}$ 24-hour NAAQS and $PM_{2.5}$ 24-hour Increment are different from each other. These are described in Table 3-1 and Table 3-2 respectively.
    - The $PM_{2.5}$ 24-hour NAAQS is the 98th percentile concentration averaged over three years,
    - The $PM_{2.5}$ 24-hour PSD Class I increment is the 24-hour maximum, not to be exceeded more than once per year

14. U.S. Fish and Wildlife Confirmation.

- [FWS statement pending]

15. Differing Assumptions for Air Quality Modeling versus Air Quality Related Values Modeling.

- Modeling for comparison against NAAQS and PSD increments is in accordance with 40 CFR Part 51, Appendix W. Modeling of Air Quality Related Values (AQRVs) is in accordance with the Federal Land Manager's Air Quality Related Values Work Group (FLAG) Revised Phase I Report.
- A description of several reasons why the modeling of Air Quality Related Values (AQRVs) is conservative can be found in the section titled "Conservatism" in Appendix C of the Air Quality Dispersion Modeling Report, which is Appendix C of the Atlantic Shores Offshore Wind Outer Continental Shelf Air Permit Application.

16. Use of a New Air Quality Model.

- The air quality dispersion modeling analysis for the NAAQS and PSD Increment used AERMOD/AERCOARE. As described in Section 4.1 of the Air Quality Dispersion Modeling Report, a request was made to utilize AERMOD/AERCOARE instead of the Offshore Coastal Dispersion (OCD) model to EPA Region 2. The process used to document that the use of AERMOD/AERCOARE is acceptable is spelled out in 40 CFR Part 51 Appendix W Section 3.2.2(e). Approval was granted to use AEREMOD/AERCOARE provided a demonstration that shoreline fumigation is not a concern. The shoreline fumigation demonstration is included in Appendix D of the Air Quality Dispersion Modeling Report.

17. Alternative Sites, Sizes and Processes.

- Outside scope of air permit application

18. Measurement and Enforcement

- Outside scope of air permit application

19. Liability

- Outside scope of air permit application

20. Notice of Intent.

- The Project's Clean Air Act Notice of Intent was submitted to EPA on December 22, 2021 and is published online at https://www.regulations.gov/document/EPA-R02-OAR-2024-0312-0024.

21. Coastal Zone Management Act Consistency

- Although the proposed Projects will be visible from shore at certain times, this visibility will often be limited due to atmospheric conditions. In fact, the FEIS concludes that at the closest analyzed Key Observation Point (KOP), turbines would only be visible for approximately half of the year. Further discussion on the visibility of the Projects can be found in the FEIS and in Section 5.0 of Volume II of the Atlantic Shores Offshore Wind Construction and Operations Plan (COP), including proposed environmental protection measures to effectively reduce the potential visual impacts as practicable given the nature of the technology and the location of the Projects. The full Visual Impact Assessment is included as Appendix II-M1 of the COP. The COP and its appendices are publicly available on the Bureau of Ocean Energy Management's website.

Attachment 12:

BOEM's July 1, 2024 Joint Record of Decision for the Atlantic Shores Offshore Wind South Project

Record of Decision

Atlantic Shores Offshore Wind South Project

Construction and Operations Plan

July 1, 2024

U.S. Department of the Interior

Bureau of Ocean Energy Management

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

U.S. Department of Defense
U.S. Army Corps of Engineers

5.11.4.2 Option 2 – Financial and Other Contributions to BOEM's Environmental Studies Program.[29] As an alternative to conducting long-term PAM in the Lease Area, the Lessee may make a financial contribution to BOEM's Environmental Studies Partnership for an Offshore Wind Energy Regional Observation Network (POWERON) initiative on an annual basis and cooperate with the POWERON team to allow the team's access to the Lease Area for deployment, regular servicing, and retrieval of instruments. In the event the Lessee selects this Option, BOEM and the Lessee will enter into a separate agreement. The Lessee's financial contribution must provide for all activities necessary to conduct PAM within and adjacent to the Lease Area, such as vessel and staff time for regular servicing of instruments, QA/QC on data, data processing to obtain vocalizations of sound-producing species and ambient noise metrics, as well as long-term archiving of data at NCEI. At the Lessee's request, BOEM will provide an estimate of the necessary amount of the financial contribution. BOEM will also invite the Lessee to contribute to discussions about the scientific approach of the POWERON initiative via the RWSC. The Lessee may request temporary withholding of the public release (i.e., the placement into the NCEI public data archive) of raw acoustic data collected within the Lease Area for up to 180 days after collection of that data. During this temporary hold, BOEM may elect to provide the Lessee may with a copy of the raw PAM data collected under this option after the DON has cleared the data for national security concerns.

5.12 WTG, OSS, and Met Tower Foundation Installation Conditions. Monopiles must be no larger than 15 m in diameter. For all monopiles, the minimum amount of hammer energy necessary to effectively and safely install and maintain the integrity of the piles must be used. Hammer energies must not exceed 4,400 kilojoules. Pin piles must be no larger than 5 m in diameter. Hammer energies must not exceed 2,500 kJ for pin pile installation.

5.12.1 The Lessee must submit all required documents related to WTG, OSS, and met tower foundation installation conditions in Sections 5.12.2 through 5.12.3 to BOEM, BSEE via TIMSWeb with a notification email sent to protectedspecies@bsee.gov, and NMFS GARFO-PRD.

5.12.2 Seasonal and Daily Restrictions. No foundation impact pile driving activities are allowed to occur January 1 through April 30. No more than three foundation monopiles and four pin piles are allowed to be installed per day, and continuous pile-driving for 24 hours per day will not be permitted. Additionally, mandatory quiet periods of at least 4 hours (per 24 hour-period) are required. The Lessee must not conduct pile driving operations at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevent visual monitoring of the full extent of

[29] The Lessee may elect Option 2 initially or during any subsequent calendar year of monitoring, subject to agreement with BOEM and BSEE.

the clearance and shutdown zones. The lead PSO must determine when sufficient light exists to allow effective visual monitoring in all cardinal directions. If light is insufficient, the lead PSO must call for a delay until the visual clearance zone is visible in all directions or must implement the Reduced Visibility Monitoring Plan/Nighttime Pile Driving Monitoring Plan (see Section 5.6.1).

5.12.3 Use of PSOs and PAM Operators for Pile-Driving. Consistent with the requirements in the MMPA LOA and December 18, 2023, NMFS BiOp, the Lessee must use NMFS-approved PSOs and PAM operators to monitor the identified clearance and shutdown zones (see Section 5.11) before, during, and after all foundation installation activities. At minimum, nine visual PSOs must be actively observing for marine mammals and sea turtles before, during, and after pile driving. At least three visual PSOs must be stationed on the pile driving vessel and at least three visual PSOs must be stationed on each of the two secondary, PSO-dedicated vessels. The dedicated PSO vessels must be positioned in locations that maximize ability to monitor the full extent of the minimum visibility, clearance, and shutdown zones. The Lessee must adjust this distance as required based upon SFV results. At least one active PSO on each platform must have a minimum of 90 days at-sea experience working in those roles in offshore environments, with no more than 18 months elapsed since the conclusion of the at-sea experience (per the final MMPA ITA). These PSOs must maintain watch at all times when impact pile driving is underway. Concurrently, at least one PAM operator must actively monitor for vocalizing marine mammals before, during and after pile driving. Furthermore, all crew and personnel working on the Project are required to maintain situational awareness of marine mammal presence (discussed further above) and are required to report any sightings to the PSOs.

5.12.3.1 The Lessee must ensure that PSO coverage is sufficient to reliably detect marine mammals and sea turtles at the surface in the identified clearance and shutdown zones (Section 5.11) to execute any pile driving delays or shutdown requirements. If, at any point prior to or during construction, the PSO coverage is determined not to be sufficient to reliably detect marine mammals and sea turtles within the clearance and shutdown zones, additional PSOs and/or platforms must be deployed. Determinations prior to construction must be based on review of the Marine Mammal and Sea Turtle Monitoring Plan for Pile Driving (Section 5.6.1). Determinations during construction must be based on review of the weekly reports and other information, as appropriate.

5.12.3.2 The Lessee must ensure that, if the clearance and/or shutdown zones are expanded due to the verification of sound fields from Project activities, PSO coverage is sufficient to reliably monitor the expanded clearance and/or shutdown zones. Additional observers must be deployed on additional platforms for every 1,500 m that a clearance or shutdown zone is expanded beyond the initial clearance and shutdown zones (Table 5.11-1; Section 5.11). In the event that the clearance or shutdown zone for protected species needs to be expanded, the Lessee must submit a

Appendix B

OCSLA Compliance Review of the Construction and Operations Plan for the Atlantic Shores Offshore Wind South Project

United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT
WASHINGTON, DC 20240-0001

Information Memorandum

To: Elizabeth Klein
Director, Bureau of Ocean Energy Management

From: David Diamond DAVID DIAMOND Digitally signed by DAVID DIAMOND Date: 2024.07.01 16:17:08 -04'00'
Deputy Chief for Operations, Atlantic Outer Continental Shelf, Office of Renewable Energy Programs

Subject: Compliance Review of the Construction and Operations Plan for the Atlantic Shores Offshore Wind South Projects for Commercial Lease OCS-A 0499

1 SUMMARY

Subsection (4) of the Outer Continental Shelf Lands Act (OCSLA), 43 U.S.C. § 1337(p)(4), requires the Secretary of the Interior (Secretary) to approve activities in a manner that provides for 12 enumerated factors. This memorandum documents the Bureau of Ocean Energy Management's (BOEM) compliance review of the construction and operations plan (COP)[1] for the Atlantic Shores Offshore Wind South Project (Atlantic Shores) consisting of Project 1 and Project 2 (hereinafter "Project")[2] on Commercial Lease OCS-A 0499, and BOEM's consideration of the 12 factors (hereinafter "8(p)(4) factors").[3]

[1] Atlantic Shores Construction and Operations Plan (May 2024), https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.
[2] This memorandum considers the Project as modified by the preferred alternative in the final EIS, Alternative B, in combination with BOEM-Proposed Mitigation Measure #5, NMFS Proposed Mitigation Measure #1, and Alternatives C4, D3, and E. Bureau of Ocean Energy Mgmt., BOEM 2024-018, Atlantic Shores Offshore Wind South Project Final Environmental Impact Statement, (2024) [hereinafter final EIS].
[3] *See* M-Opinion 37067, entitled, "*Secretary's Duties under Subsection 8(p)(4) of the Outer Continental Shelf Lands Act When Authorizing Activities on the Outer Continental Shelf*," which provides that subsection 8(p)(4) of OCSLA "does not require the Secretary to ensure that the goals are achieved to a particular degree, and she retains wide discretion to determine the appropriate balance between two or more goals that conflict or are otherwise in tension." Solicitors' M-Opinions are legal interpretations that are binding on DOI as a whole. Dep't of the Interior, Departmental Manual, 209 DM 3.1, 3.2A(11) (2020).

BOEM has determined that the Project will comply with the Bureau's regulations[4] and that the proposed activities will be carried out in a manner that provides for safety, protection of the environment, prevention of waste, and the other subsection 8(p)(4) factors.

2 BACKGROUND AND PROJECT OVERVIEW

Subsection 8(p)(7) of OCSLA, 43 U.S.C. § 1337(p)(7), directs the Department of the Interior (DOI), through BOEM, to provide for coordination and consultation with the Governor of any state or the executive of any local government that may be affected by a lease, easement, or right-of-way authorizing renewable energy activities on the Outer Continental Shelf (OCS). BOEM formed the BOEM/New Jersey Renewable Energy Task Force for coordination among affected federal agencies and state, local, and Tribal governments through the leasing process. The first Task Force meeting was held on November 24, 2009; subsequent meetings were held on May 12, 2010; November 19, 2010; December 18, 2012; January 28, 2014; April 22, 2014; and May 19, 2016. The BOEM/New Jersey Task Force was integrated into the New York Bight Task Force in December 2017.

2.1 Planning, Analysis, and Leasing

Working with the Task Force, BOEM identified a Wind Energy Area (WEA), which was then published in the New Jersey Call for Information and Nominations of Interest ("Call") *Federal Register* notice on April 20, 2011 (76 Fed. Reg. 22,130). The WEA and Call Area were delineated with the goal of providing protection of ecologically sensitive areas and minimizing user conflicts while making an appropriate area available for commercial offshore wind development. The WEA and Call area were developed using the boundary of New Jersey's Ocean/Wind Power Ecological Baseline Studies (OWPEBS) as a base and the results of the OWPEBS[5] to help identify areas that may not be suitable for development, based on features ranging from physical obstructions and usages to the presence and density of biological resources, including avian populations and aquatic habitat. Details on areas removed from leasing consideration are described in the Call. OCS lease blocks within and directly south of the Traffic Separation Scheme Approaches to New York were removed on the recommendation of the U.S. Coast Guard (USCG), as were OCS blocks within one nautical mile of an identified traditional tug and barge transit route.

The WEA was further reduced in area when the New Jersey Proposed Sale Notice was published in the *Federal Register* on July 21, 2014 (79 Fed. Reg. 42,361). This reduction was the result of an additional vessel traffic analysis, which showed that offshore wind development in OCS blocks just south of the Ambrose to Barnegat traffic lane created a navigational obstacle of vessel traffic out of New York Harbor. To alleviate navigational safety concerns resulting from vessel transits out of the New York Harbor, approximately two OCS blocks were removed from the eastern side of the WEA.

---

[4] All part 585 citations in this memorandum are to the regulations as they existed prior to July 15, 2024, when the provisions of the Renewable Energy Modification Rule will become effective. 89 Fed. Reg. 42602 (May 15, 2024).
[5] *See* the baseline studies, January 2008-December 2009 at the New Jersey State Library website: https://dspace.njstatelib.org/xmlui/handle/10929/68435.

After these reviews, analyses, and revisions to the WEA, BOEM held a competitive lease sale in November 2015, pursuant to 30 C.F.R § 585.211, for certain lease areas within the New Jersey WEA. The lease sale resulted in BOEM's issuance of Commercial Lease OCS-A 0499 to US Wind Inc. The lease became effective on March 1, 2016.

2.2 Lease Assignment and Segregation

On November 16, 2018, BOEM received an application from US Wind Inc. to assign 100 percent of Lease Area OCS-A 0499 to EDF Renewables Development, Inc. BOEM approved the assignment on December 4, 2018.[6] On April 29, 2019, BOEM received an application from EDF Renewables Development, Inc. to assign 100 percent of commercial lease OCS-A 0499 to Atlantic Shores Offshore Wind, LLC. BOEM approved the assignment on August 13, 2019.[7] On September 28, 2021, BOEM received an application from Atlantic Shores Offshore Wind, LLC to assign 100 percent interest of the southern portion of Lease Area OCS-A 0499 (which contains the Atlantic Shores South Project 1 and 2 areas) to Atlantic Shores Offshore Wind Project 1, LLC and Atlantic Shores Offshore Wind Project 2, LLC with each entity having a 50 percent interest. On April 18, 2022, BOEM approved the request and a partial assignment that effected a segregation of lease OCS-A 0499 into two separate and distinct leases.[8] The northern portion of OCS-A 0499 was retained by Atlantic Shores Offshore Wind, LLC and given a new lease number (OCS-A 0549) by BOEM. The southern portion retains the original lease number assigned by BOEM (OCS-A 0499) and is assigned to Atlantic Shores Offshore Wind Project 1, LLC and Atlantic Shores Offshore Wind Project 2, LLC (collectively Atlantic Shores Offshore Wind, or Atlantic Shores). Lease OCS-A 0499 is commonly referred to ASOW South and Lease OCS-A 0549 is commonly referred to as ASOW North.

Lease OCS-A 0499 does not by itself authorize Atlantic Shores to conduct any activities within the leased area. Under Lease OCS-A 0499[9] and 30 C.F.R. part 585, Atlantic Shores must first submit and receive approval of a Site Assessment Plan (SAP) or a COP before any activities may take place on the OCS.[10]

2.3 Site Assessment

On December 8, 2019, Atlantic Shores submitted a SAP for Lease OCS-A 0499. The SAP was subsequently revised on February 4, 2020; March 26, 2020; April 6, 2020; August 21, 2020; September 17, 2020; and November 16, 2020. BOEM approved the SAP on April 18, 2021. The plan detailed the methods and procedures Atlantic Shores would use to collect and analyze data and information on the meteorological and oceanographic conditions of the Lease Area. The

[6] *See* https://www.data.bsee.gov/PDFDocs/Scan/RENLEASES/0/344.pdf
[7] *See* https://www.data.bsee.gov/PDFDocs/Scan/RENLEASES/0/423.pdf
[8] *See* https://www.data.bsee.gov/PDFDocs/Scan/RENLEASES/0/564.pdf
[9] https://www.boem.gov/sites/default/files/documents/oil-gas-energy/OCS-A%200499%20Lease.pdf
[10] *See* 30 C.F.R. § 585.600(b).

Attachment 13:

December 1, 2022 Letter from
Suilin Chan to A. J. Jablonowski

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 2
290 BROADWAY

NEW YORK, NY 10007-1866

December 1, 2022

VIA ELECTRONIC MAIL

Mr. A. J. Jablonowski, P.E., Principal
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754
ajablonowski@epsilonassociates.com

Re: Atlantic Shores Offshore Wind, LLC – Outer Continental Shelf Air Permit Application

Dear Mr. Jablonowski:

This letter is in response to your October 28, 2022, Outer Continental Shelf (OCS) submittal regarding the OCS permit application incompleteness letter sent by the U.S. Environmental Protection Agency (EPA), Region 2 Office on September 30, 2022. This letter is also a follow-up to a TEAMS call that Atlantic Shores ("AS") and EPA had on November 10, 2022, on the same issue.

A review of the submittal reveals that it does not include all the information requested. Again, the air quality analysis does not contain sufficient information to demonstrate compliance with the National Ambient Air Quality Standard (NAAQS) or Prevention of Significant Deterioration (PSD) increments. The application is also missing certain information necessary for a BACT/LAER analysis. Please see Attachment 1 for details.

The regulations at 40 CFR § 55.6(a)(1)(i) require that an applicant submit all information necessary to perform any analysis or make any determination required under § 55.6. Based on our review of Atlantic Shores' additional submittal, the EPA has determined that the application is not complete. Following EPA's receipt of a revised/augmented permit application from AS containing all necessary components, EPA will review that application and either determine that it is complete or identify the missing information that AS must submit to enable EPA to resume processing of the application.

Please submit the information detailed in Attachment 1 to this letter so that EPA may resume its review of Atlantic Shores' OCS application. Please provide the requested information by no later than December 31, 2022, or let us know as soon as possible if a complete response will not be possible by this date.

We look forward to continuing to work with you on this project. If you wish to discuss any of the below comments or requests for information or have any questions, please contact Annamaria Colecchia of my staff at 212-637-4016 or colecchia.annamaria@epa.gov (for issues related to air quality analysis and environmental justice), or Frank Jon of my staff at 212-637-4085 or jon.frank@epa.gov (for all other issues).

Sincerely,

Chan, Suilin Digitally signed by Chan, Suilin Date: 2022.12.01 17:28:19 -05'00'

Suilin W. Chan, Chief
Permitting Section
Air and Radiation Division

Enclosures:

1) Attachment 1

2) EPA document entitled: Photochemical Model Estimated Relationships Between Offshore Wind Energy Project Precursor Emissions and Downwind Air Quality (O_3 and $PM_{2.5}$) Impacts

cc: Scott Bowles, EPA
Emily French, EPA
Catherine Collins, US FWS
Tim Allen, US FWS
Kimberly Sullivan, BOEM
Francis Steitz, NJDEP
Kennett Ratzman, NJDEP
Danny Wong, NJDEP

ATTACHMENT 1

I. Air Quality Impact Assessment

The air quality analysis does not contain sufficient information to demonstrate compliance with the National Ambient Air Quality Standard (NAAQS) or Prevention of Significant Deterioration (PSD) increments. Additional information or clarification is needed as discussed below.

1. EPA continues to review the modeling analysis to determine if additional information or clarification is needed. This includes the appropriateness of the clustered emissions approach, Atlantic Shores' October 28, 2022 response to EPA's air quality comments, in particular the statistical justification provided to address the potential for overlapping impacts, and the use of EPA's March 1, 2011 clarification memo which contains guidance on modeling intermittent emission sources.

2. As previously requested, a document that contains the readme files remains outstanding.

3. An equivalency demonstration per EPA's December 11, 2007 guidance memo, which is omitted, is required given that a parallelized version of the regulatory version of AERMOD was used in this case. See the included link for further guidance. https://www.epa.gov/sites/default/files/2020-10/documents/clarification_on_reg._status_of_prop._versions_of_aermod.pdf

4. On November 15, 2022, EPA Region 2 provided AS with a Technical Support Document which EPA recently finished that includes updated Modeled Emission Rates for Precursors (MERPs) applicable to overwater emissions. It should be noted that there was an error in the ozone table. A revised copy is enclosed with this letter. This should be used for your analyses.

5. EPA awaits confirmation from the US Fish and Wildlife Service (FWS) that it is satisfied with the impact analysis for the Air Quality Related Values (AQRVs) on the Class I area in the Brigantine Wildlife Refuge. We will inform you if additional information is requested by the FWS to address the AQRVs.

II. BACT, LAER, and Other Issues

1. With respect to Atlantic Shores' response regarding the applicability of the California LAER SIP requirements to the Atlantic Shores' vessels, EPA will continue this review during the technical review phase of the application and, if necessary, will provide you with a response at that time.

2. With respect to Atlantic Shores' response to the SF6-free switchgears for both the WTG and the OSS, we can revisit this issue in the future as AS gathers more information on what SF6-free equipment will be available by the time AS reaches contractual

negotiations. It is our understanding from Siemens that the initial costs of SF6-free switchgears are much higher than conventional ones because of the larger size of these SF6-free units and that these costs would be offset by the lower operating and end of life costs. Please provide any additional information that results from your search and keep us informed of any new developments regarding this issue.

3. With respect to EPA's request for a cost analysis for retrofitting an existing typical jack-up vessel that is being powered with a more polluting Tier 1 or Tier 2 main engine with a less polluting Tier 3 and Tier 4 main engine, EPA notes that AS did not provide this requested analysis. We should note that on Page 99 of 340 of Atlantic Shores' permit application, AS quotes, in pertinent part, the EPA's NSR Workshop Manual (1990), "A LAER is not considered achievable if the **cost of control is so great** [emphasis added] that a major new source could not be built or operated…" As of now, the permit record for this project does not provide a sense of the magnitude of this control cost. If AS is not willing to provide a detailed cost analysis, it should, at the minimum, include in the permit record a cost range of such retrofit and the number of months it would take to retrofit and respond to the other questions posed on the September 30, 2022 EPA letter regarding this issue.

4. EPA Region 2 recently became aware that EPA HQ updated the "Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions" in April 2022. See https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1014J1S.pdf. This April 2022 version is an update of the September 2020 version and supersedes it. The emissions factors/estimates used in Atlantic Shores' permit application will need to conform with this latest guidance wherever there is a discrepancy.

Attachment 14:

September 3, 2024 Email from
Tim Allen (FWS) to Suilin Chan et al. (EPA)

From:	Allen, Tim
To:	Chan, Suilin; Sareen, Neha (she/her/hers); Marmo, Brian (he/him/his)
Cc:	Cragan, Clare E; Ming, Jaron E
Subject:	FWS response to ASOS questions #14 and #15
Date:	Tuesday, September 3, 2024 11:55:11 AM

Hi Suilin,

Here are the FWS responses to questions #14 and #15 that you previously sent.

Thank you,
Tim

14. U.S. Fish and Wildlife Confirmation.
The EPA, in its letter of December 1, 2022, indicated that the application would not be complete pending confirmation from the Fish and Wildlife Service (FWS) that it is satisfied with the impact analysis for the air quality related values at the Brigantine Wildlife Area. We have not seen such confirmation, again raising questions as to why the application was deemed complete and released for public comment. The FWS position on this application should be disclosed.

FWS Response…
On August 18th, 2023, the U.S. Fish & Wildlife Service (FWS) sent an email message to the Environmental Protection Agency, Region 2 air quality staff stating that we considered the Atlantic Shores - South air quality permit application complete. Though we agreed that the required portions of the permit application were present, the FWS followed a common practice of requesting the applicant to respond to additional questions or additional analysis requests into the future. We did participate with EPA, ask questions of the applicant, and reviewed new materials as they were produced through the full permitting process. The FWS works with all applicants to minimize air quality impacts to Class I areas and public lands that we manage.

15. Differing Assumptions for Air Quality Modeling versus Air Quality Related Values Modeling.
They appear to be different approaches taken regarding the two sets of modeling. The application should explain why.

FWS Response...

The U.S. Fish & Wildlife Service follows the Federal Land Managers' Air Quality Related Values Work Group, Revised 2010 (FLAG) federal guidance document in how it evaluates impacts to Class I areas during air permit application review. Air Quality Related Values (AQRV) evaluation primarily looks at short-term visibility impairment and long-term aerosol deposition which differs from the human health standards EPA protects. We often use different models, timescales, and emission character layouts to better evaluate the AQRV impact.

Attachment 15:

Documents 6.1, 6.2, 6.3, 6.4, 6.5, and 6.6 from the Administrative Record Regarding FWS Review

Document 6.1

"6.1 FWS Emails to EPA July 31 2024"

From:	Chan, Suilin
To:	Allen, Tim; Ming, Jaron E
Cc:	Jon, Frank; Froikin, Sara (she/her/hers); Marmo, Brian (he/him/his)
Subject:	RE: [EXTERNAL] FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project
Date:	Wednesday, July 31, 2024 1:25:02 PM

Thank you Tim!

From: Allen, Tim <tim_allen@fws.gov>
Sent: Wednesday, July 31, 2024 11:55 AM
To: Chan, Suilin <Chan.Suilin@epa.gov>; Ming, Jaron E <jaron_ming@fws.gov>
Cc: Jon, Frank <Jon.Frank@epa.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Subject: Re: [EXTERNAL] FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project

Caution: This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

Will do, thank you.
Tim

From: Chan, Suilin <Chan.Suilin@epa.gov>
Sent: Wednesday, July 31, 2024 9:23 AM
To: Allen, Tim <tim_allen@fws.gov>; Ming, Jaron E <jaron_ming@fws.gov>
Cc: Jon, Frank <Jon.Frank@epa.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Subject: RE: [EXTERNAL] FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project

Hi Tim,

Please prepare a response to each comment as it comes in and share it with us via email. However, after you are done responding to all comments received, I would like to receive a final memo that totals up all comments and responses in one piece.

Thanks,
Suilin

From: Allen, Tim <tim_allen@fws.gov>
Sent: Wednesday, July 31, 2024 10:46 AM
To: Chan, Suilin <Chan.Suilin@epa.gov>; Ming, Jaron E <jaron_ming@fws.gov>
Cc: Jon, Frank <Jon.Frank@epa.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>

Subject: Re: [EXTERNAL] FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project

> **Caution:** This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

Suilin,

Two questions:

1. Would you like us to respond as they come, or wait and respond to all questions at once? I assume there will be more.
2. How formal would you like the response(s)? Would an email do or would you like a pdf style memo?

Tim

From: Chan, Suilin <Chan.Suilin@epa.gov>
Sent: Wednesday, July 31, 2024 7:06 AM
To: Allen, Tim <tim_allen@fws.gov>; Ming, Jaron E <jaron_ming@fws.gov>
Cc: Jon, Frank <Jon.Frank@epa.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Subject: RE: [EXTERNAL] FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project

Thanks Tim!

From: Allen, Tim <tim_allen@fws.gov>
Sent: Wednesday, July 31, 2024 8:44 AM
To: Chan, Suilin <Chan.Suilin@epa.gov>; Ming, Jaron E <jaron_ming@fws.gov>
Cc: Jon, Frank <Jon.Frank@epa.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Subject: Re: [EXTERNAL] FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project

> **Caution:** This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

Hi Suilin,

I have the attachment and am reviewing the questions.

Thank you,
Tim

From: Chan, Suilin <Chan.Suilin@epa.gov>
Sent: Wednesday, July 31, 2024 6:07 AM
To: Ming, Jaron E <jaron_ming@fws.gov>
Cc: Allen, Tim <tim_allen@fws.gov>; Jon, Frank <Jon.Frank@epa.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Subject: [EXTERNAL] FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Good morning Jaron,

We received comments from the Save Long Beach Island regarding the Atlantic Shores OCS draft permit. See attached. In particular, Comments #14 and 15 concern the U.S. Fish and Wildlife and the AQRV modeling. We need your help to respond to these comments. Would it be possible for you to provide your writeup to me by 8/30/2024 to avoid delays in the final permit decision?

Thanks,
Suilin

From: Jon, Frank <Jon.Frank@epa.gov>
Sent: Wednesday, July 31, 2024 7:32 AM
To: Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Petriman, Viorica (she/her/hers) <Petriman.Viorica@epa.gov>
Cc: Chan, Suilin <Chan.Suilin@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>; Yoon, Jonathan (he/him/his) <Yoon.Jonathan@epa.gov>
Subject: FW: OCS Air Permit , Brigantine National Wilderness Area, Atlantic Shores Project

FYI. As expected, public comments regarding air quality modeling and other issues.

Document 6.2

“6.2 FWS Emails to EPA Aug 27 to 28 2024”

Jon, Frank

Subject: FW: ASOS Comments

From: Jon, Frank
Sent: Wednesday, August 28, 2024 4:38 PM
To: Allen, Tim <tim_allen@fws.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>
Subject: RE: ASOS Comments

Hi Tim,

These are the comments from Atlantic Shores. They are requesting changes to some of the permit conditions/limits. I believe we will prepare the responses to all of these comments, but we would like your input on some of the statements made by Atlantic Shores as to the effect of the requested changes to the AQRV and the Brigantine Wilderness Area (whether you agree or not with AS).

Thanks,

Frank

From: Allen, Tim <tim_allen@fws.gov>
Sent: Wednesday, August 28, 2024 10:42 AM
To: Jon, Frank <Jon.Frank@epa.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>
Subject: Re: [EXTERNAL] RE: ASOS Comments

> **Caution:** This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

Thank you, Frank.

I will send our response to the two previous comments and be ready for more. The previous two questions are simple process questions and easy to document.

Tim

From: Jon, Frank <Jon.Frank@epa.gov>
Sent: Wednesday, August 28, 2024 8:32 AM
To: Chan, Suilin <Chan.Suilin@epa.gov>; Allen, Tim <tim_allen@fws.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>

Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>
Subject: [EXTERNAL] RE: ASOS Comments

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hi Tim,

We have a contractor who is helping us compile all the comments received near the end of the public comment period. We have not yet received the deliverables. However, I am attaching a comment letter that may or may not include issues for FWS, probably not. But I and sending it to you just in case. [redacted]

Thanks,

Frank

From: Chan, Suilin <Chan.Suilin@epa.gov>
Sent: Tuesday, August 27, 2024 12:05 PM
To: Allen, Tim <tim_allen@fws.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>; Jon, Frank <Jon.Frank@epa.gov>
Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>
Subject: RE: ASOS Comments

Hi Tim,

I am cc'ing Frank Jon here who would have the answer to your question. He is the keeper of all the public comments :)

Suilin

From: Allen, Tim <tim_allen@fws.gov>
Sent: Tuesday, August 27, 2024 10:46 AM
To: Chan, Suilin <Chan.Suilin@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>
Subject: ASOS Comments

Caution: This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

Hi Suilin,

I wanted ask if you received additional comments best answered by the FWS? I am ready to respond to the two you've already provided but want to be sure there are no more.

[redacted]

Thank you,
Tim

Document 6.3

"6.3 FWS Emails to EPA Aug 30 to Sep 3 2024"

Subject: FW: Draft FWS Response to Questions #14 and #15
Date: Monday, September 30, 2024 1:17:23 PM

From: Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Sent: Tuesday, September 3, 2024 3:28 PM
To: Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Subject: FW: Draft FWS Response to Questions #14 and #15

From: Cragan, Clare E <clare.cragan@sol.doi.gov>
Sent: Tuesday, September 3, 2024 11:34 AM
To: Allen, Tim <tim_allen@fws.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Cc: Ming, Jaron E <jaron_ming@fws.gov>
Subject: Re: Draft FWS Response to Questions #14 and #15

Caution: This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

Thanks, Tim. [redacted]

Best,
Clare

From: Allen, Tim <tim_allen@fws.gov>
Sent: Friday, August 30, 2024 11:48 AM
To: Cragan, Clare E <clare.cragan@sol.doi.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Sareen, Neha <sareen.neha@epa.gov>
Cc: Ming, Jaron E <jaron_ming@fws.gov>
Subject: Draft FWS Response to Questions #14 and #15

Hi Suilin,

Here are our draft responses to questions #14 and #15. I am continuing to use the word draft to give our solicitor a bit more time, yet make sure you can see them today. Please do not publish these responses until we hear from Clare.

I am concluding that Q#14 is simply asking if we concurred with EPA about completeness. That simple answer is yes.

Neha asked a separate question regarding monitoring at the Refuge. Neha, I agree fully with the draft response I saw. To the request for more monitors, we have IMPROVE and NADP deployed and NJ has always managed a comprehensive suite on-site. Short of a special study collection, I don't see we can add. Your draft response also highlighted the difficulty of parsing the monitoring data for specific activity. Once the developments begin, it will be very difficult without perhaps a model, to identify what on a monitor is coming from what.

Thank you,
Tim

14. U.S. Fish and Wildlife Confirmation.
The EPA, in its letter of December 1, 2022, indicated that the application would not be complete pending confirmation from the Fish and Wildlife Service (FWS) that it is satisfied with the impact analysis for the air quality related values at the Brigantine Wildlife Area. We have not seen such confirmation, again raising questions as to why the application was deemed complete and released for public comment. The FWS position on this application should be disclosed.

FWS Draft Response…
On August 18th, 2023, the U.S. Fish & Wildlife Service (FWS) sent an email message to the Environmental Protection Agency, Region 2 air quality staff stating that we considered the Atlantic Shores - South air quality permit application complete. Though we agreed that the required portions of the permit application were present, the FWS followed a common practice of requesting the applicant to respond to additional questions or additional analysis requests into the future. We did participate with EPA, ask questions of the applicant, and review new materials as they were produced through the full permitting process. The FWS works with all applicants to minimize air quality impacts to Class I areas and public lands that we manage.

15. Differing Assumptions for Air Quality Modeling versus Air Quality Related Values Modeling.
They appear to be different approaches taken regarding the two sets of modeling. The

application should explain why.

FWS Draft Response…

The U.S. Fish & Wildlife Service follows the Federal Land Managers' Air Quality Related Values Work Group, Revised 2010 (FLAG) federal guidance document in how it evaluates impacts to Class I areas during air permit application review. Air Quality Related Values (AQRV) evaluation primarily looks at short-term visibility impairment and long-term aerosol deposition which differs from the human health standards EPA protects. We often use different models, timescales, and emission character layouts to better evaluate the AQRV impact. [redacted]

Document 6.4

“6.4 FWS Emails to EPA Sep 3 2024”

From:	Allen, Tim
To:	Chan, Suilin; Sareen, Neha (she/her/hers); Marmo, Brian (he/him/his)
Cc:	Cragan, Clare E; Ming, Jaron E
Subject:	FWS response to ASOS questions #14 and #15
Date:	Tuesday, September 3, 2024 11:55:11 AM

Hi Suilin,

Here are the FWS responses to questions #14 and #15 that you previously sent.

Thank you,
Tim

14. U.S. Fish and Wildlife Confirmation.
The EPA, in its letter of December 1, 2022, indicated that the application would not be complete pending confirmation from the Fish and Wildlife Service (FWS) that it is satisfied with the impact analysis for the air quality related values at the Brigantine Wildlife Area. We have not seen such confirmation, again raising questions as to why the application was deemed complete and released for public comment. The FWS position on this application should be disclosed.

FWS Response…
On August 18th, 2023, the U.S. Fish & Wildlife Service (FWS) sent an email message to the Environmental Protection Agency, Region 2 air quality staff stating that we considered the Atlantic Shores - South air quality permit application complete. Though we agreed that the required portions of the permit application were present, the FWS followed a common practice of requesting the applicant to respond to additional questions or additional analysis requests into the future. We did participate with EPA, ask questions of the applicant, and reviewed new materials as they were produced through the full permitting process. The FWS works with all applicants to minimize air quality impacts to Class I areas and public lands that we manage.

15. Differing Assumptions for Air Quality Modeling versus Air Quality Related Values Modeling.
They appear to be different approaches taken regarding the two sets of modeling. The application should explain why.

FWS Response...
The U.S. Fish & Wildlife Service follows the Federal Land Managers' Air Quality Related Values Work Group, Revised 2010 (FLAG) federal guidance document in how it evaluates impacts to Class I areas during air permit application review. Air Quality Related Values (AQRV) evaluation primarily looks at short-term visibility impairment and long-term aerosol deposition which differs from the human health standards EPA protects. We often use different models, timescales, and emission character layouts to better evaluate the AQRV impact.

Document 6.5

“6.5 FWS Emails to EPA Aug 28 to Sep 5 2024”

From:	Marmo, Brian (he/him/his)
To:	Allen, Tim; Jon, Frank; Chan, Suilin; Sareen, Neha (she/her/hers)
Cc:	Cragan, Clare E; Froikin, Sara (she/her/hers); Ming, Jaron E; Rettig, Virginia
Subject:	RE: [EXTERNAL] RE: ASOS Comments
Date:	Thursday, September 5, 2024 3:52:00 PM

Thanks again Tim, we appreciate it!

Brian Marmo
Physical Scientist
Air Permitting Section
Air and Radiation Division
United States Environmental Protection Agency, Region 2
Phone: 212-637-4352
Email: Marmo.Brian@epa.gov

From: Allen, Tim <tim_allen@fws.gov>
Sent: Wednesday, September 4, 2024 2:13 PM
To: Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Jon, Frank <Jon.Frank@epa.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Ming, Jaron E <jaron_ming@fws.gov>; Rettig, Virginia <virginia_rettig@fws.gov>
Subject: Re: [EXTERNAL] RE: ASOS Comments

Good Afternoon,

Thank you again for the opportunity to contribute to the Atlantic Shores - South air quality permit response to comments documentation. The following is our response to the request to increase SO2 emissions.

FWS Response:
The U.S. Fish & Wildlife Service (FWS) does not support increasing sulfur emission limits to the Prevention of Significant Deterioration (PSD) trigger level for the Atlantic Shores – South, Wind Energy air quality permit.

Utilizing federal FLAG 2010 guidance, FWS routinely asks that all impairing emission increases be included during air quality PSD permit review. This ensures that all potential impacts to Class I areas are evaluated together. Each pollution species has a unique influence on Air Quality Related Values (AQRV) yet combines to produce a comprehensive impact to the Wilderness.

Increases to SO2 emissions affect visibility in both the near- and far-field and varies considerably during the life of the project. Sulfur deposition also contributes to acidification of soils, coastal marsh, and requires additional evaluation.

The revised visibility tables included with the comment letter are insufficient to inform our review. The FWS would consider the request to increase SO2 emissions to 40 tons per year a significant change to the application requiring renotification.

Tim Allen
U.S. Fish & Wildlife Service

From: Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Sent: Tuesday, September 3, 2024 2:06 PM
To: Allen, Tim <tim_allen@fws.gov>; Jon, Frank <Jon.Frank@epa.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>
Subject: RE: [EXTERNAL] RE: ASOS Comments

Hi Tim,

As part of the comments submitted by Atlantic Shores, we received the following statement from them under "Clarifications to the Fact Sheet" on page 7:

"Page 15 of 67: Per above, we note that the SO2 emissions do not contribute meaningfully to modeled AQRV impacts."

Because the statement references the AQRVs, we wanted to get your input on this.

Thank you,

Brian Marmo

Physical Scientist

Air Permitting Section

Air and Radiation Division

United States Environmental Protection Agency, Region 2

Phone: 212-637-4352

Email: Marmo.Brian@epa.gov

From: Allen, Tim <tim_allen@fws.gov>
Sent: Wednesday, August 28, 2024 5:20 PM
To: Jon, Frank <Jon.Frank@epa.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>
Cc: Cragan, Clare E <clare.cragan@sol.doi.gov>; Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>
Subject: Re: [EXTERNAL] RE: ASOS Comments

Will do, thank you!

Tim

Document 6.6

“6.6 FWS Emails to EPA Sep 18 to Sep 24 2024”

From:	Marmo, Brian (he/him/his)
To:	"Ming, Jaron E"
Subject:	RE: [EXTERNAL] RE: ASOS Comments
Date:	Tuesday, September 24, 2024 9:31:00 AM

Thank you Jaron, I appreciate it!

Brian

From: Ming, Jaron E <jaron_ming@fws.gov>
Sent: Thursday, September 19, 2024 9:47 AM
To: Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Cc: Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Jon, Frank <Jon.Frank@epa.gov>; Allen, Tim <tim_allen@fws.gov>
Subject: Re: [EXTERNAL] RE: ASOS Comments

> **Caution:** This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

Hi Brian. Thank your for forwarding the comment and proposed response. We do not have any conflict with the statement you propose. Thanks!

From: Marmo, Brian (he/him/his) <Marmo.Brian@epa.gov>
Sent: Wednesday, September 18, 2024 1:43 PM
To: Ming, Jaron E <jaron_ming@fws.gov>
Cc: Froikin, Sara (she/her/hers) <Froikin.Sara@epa.gov>; Sareen, Neha (she/her/hers) <sareen.neha@epa.gov>; Chan, Suilin <Chan.Suilin@epa.gov>; Jon, Frank <Jon.Frank@epa.gov>; Allen, Tim <tim_allen@fws.gov>
Subject: RE: [EXTERNAL] RE: ASOS Comments

Hi Jaron,

I saw that Tim Allen was out of the office, so I wanted to reach out regarding a comment we received (see below):

> *Comment: The EPA, and by extension, BOEM, need to take into consideration the cumulative effects of not only the Project's Atlantic Shores wind turbines, but also the wind turbines of the nearby Ocean Wind lease area, which is eligible to go back on the market for another lease, in addition to the NY Bight projects, as well as consider other BOEM leases in the surrounding area.*

> *Brigantine, less than five miles from Atlantic City, unfortunately straddles all these projects , and there is a total of more than 1,800 wind turbines now projected for the area.*

This comment is regarding the cumulative effects of the wind projects, and mentions Brigantine. I wanted to check what the FWS's policy is on cumulative impacts from these projects for the AQRVs. We prepared the following language below. Does this language conflict with the FWS's policy?

"The effects of each nearby wind farm project on the NAAQS and PSD increment and on the Brigantine National Wilderness Area will be evaluated, including its cumulative effects with other nearby wind farms with issued OCS air permits or with complete OCS air permit applications, as OCS air permit applications come in for review."

Thank you,

Brian Marmo

Physical Scientist

Air Permitting Section

Air and Radiation Division

United States Environmental Protection Agency, Region 2

Phone: 212-637-4352

Email: Marmo.Brian@epa.gov

Attachment 16:

BOEM's Final Environmental Impact Statement,
Volume I

OCS EIS/EA
BOEM 2024-0008
Docket Number: BOEM-2024-0018

Atlantic Shores Offshore Wind South Final Environmental Impact Statement

May 2024

Estimated Lead Agency Costs Associated with Developing and Producing this Final EIS: $3,771,160

U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849

BOEM
Bureau of Ocean Energy Management

that the EIS satisfies USACE's comments and recommendations. Based on its participation as a cooperating agency and its consideration of the Final EIS, USACE would issue its own Record of Decision (ROD) to formally document its decision on the Proposed Action. The ROD would be a combined decision document for both the USACE Regulatory Branch and the Section 408 Program.

ES.3 Public Involvement

On September 30, 2021, BOEM issued a Notice of Intent (NOI) to prepare an EIS consistent with NEPA regulations (42 USC 4321 et seq.), initiating a 30-day public scoping period from September 30 to November 1, 2021 (86 *Federal Register* 54231). The NOI solicited public input on the significant resources and issues, impact-producing factors, reasonable alternatives, and potential mitigation measures to analyze in the EIS. BOEM also used the NEPA scoping process to initiate the Section 106 consultation process under the National Historic Preservation Act (54 USC 300101 et seq.), as permitted by 36 CFR 800.2(d)(3), and sought public comment and input through the NOI regarding the identification of historic properties or potential effects on historic properties from activities associated with approval of the Atlantic Shores South COP. BOEM held three virtual public scoping meetings on October 19, 21, and 25, 2021, to present information on the Project and NEPA process, answer questions from meeting attendees, and solicit public comments. Scoping comments were received through Regulations.gov on docket number BOEM-2021-0057, via email and postal mail to a BOEM representative, and through oral testimony at each of the three public scoping meetings. BOEM received a total of 246 comment submissions from federal, tribal, and state agencies; local governments; non-governmental organizations; and the general public during the scoping period. The topics most referenced in the scoping comments included the NEPA/public involvement process, marine mammals, planned activities scenario/cumulative impacts, commercial fisheries and for-hire recreational fishing, mitigation and monitoring, climate change, employment and job creation, and scenic and visual resources. BOEM considered all scoping comments while preparing this Final EIS.

On May 19, 2023, BOEM issued a Notice of Availability of the Draft EIS, initiating a 45-day public comment period. BOEM held a total of four public meetings. Two in-person meetings were held in Manahawkin, New Jersey, and Atlantic City, New Jersey, on June 21 and June 22, 2023, respectively. Two virtual meetings were held on June 26 and 28, 2023. BOEM received a total of 2,096 comment submissions during the comment period. BOEM assessed and considered all the comments received on the Draft EIS in preparation of the Final EIS. See Appendix A, *Required Environmental Permits and Consultations,* for additional information on public involvement.

ES.4 Alternatives

BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. The Final EIS evaluates the No Action Alternative and six action alternatives (three of which have sub-alternatives). The action alternatives are not mutually exclusive; BOEM may select a combination of alternatives that meet the purpose and need of the proposed Project.

The alternatives are as follows:

- Alternative A – No Action
- Alternative B – Proposed Action
- Alternative C – Habitat Impact Minimization / Fisheries Habitat Impact Minimization[4]
    - Alternative C1 – Lobster Hole Avoidance
    - Alternative C2 – Sand Ridge Complex Avoidance
    - Alternative C3 – Demarcated Sand Ridge Complex Avoidance
    - Alternative C4 – Micrositing
- Alternative D – No Surface Occupancy at Select Locations to Reduce Visual Impacts[4]
    - Alternative D1 – No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore; Removal of Up to 21 Turbines
    - Alternative D2 – No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore; Removal of Up to 31 Turbines
    - Alternative D3 – No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore; Removal of Up to 6 Turbines
- Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1[4]
- Alternative F – Foundation Structures
    - Alternative F1 – Piled Foundations
    - Alternative F2 – Suction Bucket Foundations
    - Alternative F3 – Gravity-Based Foundations

The Preferred Alternative analyzed in the Final EIS is composed of a combination of Alternative B (Proposed Action), Alternative C4 (Habitat Impact Minimization/Fisheries Habitat Impact Minimization: Micrositing), Alternative D3 (No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore; Removal of Up to 6 Turbines), and Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1), as well as two proposed mitigation

[4] The number of wind turbine generators (WTGs) that could be removed may be reduced if this alternative is selected and combined with another alternative that requires removal of additional WTG positions, and if that combination of alternatives would fail to meet the purpose and need, including any awarded offtake agreement(s).

measures that require WTG removal identified in Appendix G, *Mitigation and Monitoring,* Table G-3 (BOEM-Proposed Mitigation Measure #5 and NOAA/NMFS-Proposed Mitigation Measure #1).

Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Chapter 2, Section 2.2, *Alternatives Considered but Not Analyzed in Detail*.

ES.4.1 Alternative A – No Action

Under the No Action Alternative, BOEM would not approve the COP. The Project's construction and installation, O&M, and eventual decommissioning would not occur, and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization to the applicant under the MMPA. The current resource conditions, trends, and effects from ongoing activities under the No Action Alternative serve as the existing baseline against which all direct and indirect impacts from action alternatives are evaluated.

Over the life of the proposed Project, other reasonably foreseeable future impact-producing offshore wind and non-offshore wind activities are expected to occur, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable planned activities described in Appendix D, *Ongoing and Planned Activities Scenario*, without the Proposed Action serves as the future baseline for the evaluation of cumulative impacts.

ES.4.2 Alternative B – Proposed Action

Under the Proposed Action, the construction and installation, O&M, and eventual decommissioning of the Atlantic Shores South Project, which consists of two wind energy facilities (Project 1 and Project 2) on the OCS offshore of New Jersey, would be built within the range of the design parameters outlined in the Atlantic Shores South COP (Atlantic Shores 2024), subject to applicable mitigation measures. The Atlantic Shores South Project would include up to 200 wind turbine generators (WTGs) (between 105 and 136 for Project 1, and between 64 and 95 for Project 2), up to 10 offshore substations (OSSs) (up to 5 in each Project), up to 1 permanent meteorological (met) tower (Project 1), up to 4 temporary meteorological and oceanographic (metocean) buoys (up to 3 metocean buoys in Project 1, 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations. The proposed landfall locations are the Monmouth landfall in Sea Girt, New Jersey, with an onshore route to the existing Larrabee Substation Point of Interconnection (POI) and the Atlantic landfall in Atlantic City, New Jersey, with an onshore route to the existing Cardiff Substation, which would be upgraded to accommodate the Project's POI. Project 1 would have a capacity of 1,510 MW. Project 2's capacity is not yet determined, but Atlantic Shores has a goal of 1,327 MW, which would align with the interconnection service agreement it intends to execute for both projects with the RTO, PJM. The Proposed Action is summarized in Table ES-1 and Appendix C, *Project Design Envelope and Maximum-Case Scenario*. Refer to Volume I of the Atlantic Shores COP (Atlantic Shores 2024) for additional details on Project design.

Table ES-1. Summary of Project Design Envelope parameters

Project Parameter Details
General (Layout and Project Size)
• Up to 200 total WTGs ○ A minimum of 105 WTGs to a maximum of 136 WTGs for Project 1 ○ A minimum of 64 WTGs to a maximum of 95 WTGs for Project 2 • Up to 10 OSSs • Up to 1 permanent meteorological tower • Up to 4 temporary metocean buoys • Grid layout with east-northeast/west-southwest rows and approximately north/south columns
Foundations
• The foundations for the WTGs in Project 1 would be monopile; the foundations for the WTGs in Project 2 would be monopile or piled jacket; only one foundation type would be used for all WTGs in Project 2 • The foundations for small OSSs would be monopile, piled jacket, or suction bucket; the foundations for medium or large OSSs would be piled jacket, suction bucket jacket, or GBS • The foundation for the permanent met tower would be monopile, piled jackets, suction bucket jacket, mono suction buckets, or GBS • The scour protection around all foundations would vary based on foundation type
Wind Turbine Generators
• Rotor diameter up to 918.6 feet (280 meters) • Hub height up to 574.2 feet (175 meters) AMSL • Tip height up to 1,046.6 feet (319 meters) AMSL
Offshore Substations
• Up to 10 OSSs (10 small, 5 medium, or 4 large) • Total structure height of topside above MLLW up to 174.8 feet (53.3 meters) for a small OSS, up to 191.2 feet (58.3 meters) for a medium OSS, and up to 207.6 feet (63.3 meters) for a large OSS • Maximum length of 131.2 feet (40 meters) for a small OSS, up to 213.3 feet (65 meters) for a medium OSS, up to 295.3 feet (90 meters) for a large OSS • Small OSSs would be located at least 12 miles (19.3 kilometers) from shore, whereas medium and large OSSs would be located at least 13.5 miles (21.7 kilometers) from shore
Interarray Cables
• Target burial depth of 5 to 6.6 feet (1.5 to 2 meters) • Cables would be between 66 to 150 kV HVAC • Maximum total cable length would be 547 miles (880 kilometers) ○ Up to 274 miles (440 kilometers) of HVAC interarray cables for Project 1 ○ Up to 274 miles (440 kilometers) of HVAC interarray cables for Project 2 • Cable installation may involve jet trenching, plowing/ jet plowing, or mechanical trenching
Interlink Cables
• Target burial depth of 5 to 6.6 feet (1.5 to 2 meters) • Cables would be between 66 to 275 kV HVAC • Maximum total cable length would be 37 miles (60 kilometers) ○ Up to 18.6 miles (30 kilometers) of HVAC interlink cables for Project 1 ○ Up to 18.6 miles (30 kilometers) of HVAC interlink cables for Project 2

Project Parameter Details
• Cable installation may involve jet trenching, plowing/ jet plowing, or mechanical trenching
Offshore Export Cables
• Target burial depth of 5 to 6.6 feet (1.5 to 2 meters) • 230 to 275 kV HVAC cables and/or 320 to 525 kV HVDC cables • Two ECCs: Atlantic ECC and Monmouth ECC ○ Atlantic ECC: maximum total cable length would be 99.4 miles (160 kilometers) ○ Monmouth ECC: maximum total cable length would be 341.8 miles (550 kilometers) • Maximum of 4 HVAC cables per corridor • Maximum of 1 HVDC cables per corridor Cable installation may involve jet trenching, plowing/ jet plowing, or mechanical trenching
Landfall Sites
• HDD installation of cables at two landfall sites • Atlantic Landfall Site would be located in Atlantic City, New Jersey • Monmouth Landfall Site would be located within the Borough of Sea Girt in Monmouth County, New Jersey
Permanent Meteorological Tower and Metocean Buoys
• One permanent met tower would be installed within Project 1 in one of four potential locations ○ Maximum height would not exceed 16.5 feet (5 meters) above the hub height of the largest WTG installed, estimated to be 590.6 feet (180 meters) AMSL ○ The tower would be composed of square lattice consisting of tubular steel ○ The tower would be equipped with a deck that would be approximately 50 feet by 50 feet (15 meters by 15 meters) • Up to 4 temporary metocean buoys would be installed, 3 in Project 1 and 1 in Project 2
Onshore Facilities
• Atlantic Landfall Site would be connected to the approximately 12.4- to 22.6-mile (20.0- to 36.4-kilometer) Cardiff Onshore Interconnection Cable Route that would continue to the potential site for the Cardiff Substation and/or Converter Station and terminate at the Cardiff Substation POI • Monmouth Landfall Site would be connected to the approximate 9.8- to 23.0-mile (15.8- to 37.0-kilometer) Larrabee Onshore Interconnection Cable Route, which would continue to one of three potential sites for the Larrabee Substation and/or Converter Station and terminate at the Larrabee Substation POI • 230 to 275 kV HVAC cables and/or 320 to 525 kV HVDC cables
O&M Facility
• New facility proposed in Atlantic City, New Jersey

AMSL = above mean sea level; ECC = export cable corridor; GBS = gravity-based structure; HDD = horizontal directional drilling; HVAC = high-voltage alternating current; HVDC= High-voltage direct current; kV = kilovolt; MLLW = mean lower low water.

ES.4.3 Alternative C – Habitat Impact Minimization/Fisheries Habitat Impact Minimization

Under Alternative C, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, the layout and maximum number of WTGs and OSSs would be adjusted to avoid and minimize potential impacts on important habitats. NMFS identified two areas of concern (AOCs) within the Lease Area that have pronounced bottom features and produce habitat value. AOC 1 is part of a designated recreational fishing area called “Lobster Hole.” AOC 2 is part of a sand ridge (ridge and trough) complex.

- **Alternative C1: Lobster Hole Avoidance**

  Alternative C1 would avoid and minimize the potential impacts on the Lobster Hole (AOC 1), a designated recreational fishing area, by removing up to 16 WTGs, 1 OSS, and associated interarray cables.

- **Alternative C2: Sand Ridge Complex Avoidance**

  Alternative C2 would avoid and minimize potential impacts on the sand ridge features in the southernmost portion of the Lease Area (AOC 2) by removing up to 13 WTGs and associated interarray cables within the NMFS-identified sand ridge complex.

- **Alternative C3: Demarcated Sand Ridge Complex Avoidance**

  Alternative C3 would remove up to 6 WTGs and associated interarray cables within 1,000 feet (305 meters) of the sand ridge complex area identified by NMFS, but further demarcated using NOAA's Benthic Terrain Modeler and bathymetry data provided by Atlantic Shores.

- **Alternative C4: Micrositing**

  Alternative C4 was proposed by Atlantic Shores and would involve the micrositing of 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within both AOC 1 and AOC 2.

ES.4.4 Alternative D – No Surface Occupancy at Select Locations to Reduce Visual Impacts

Under Alternative D, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, there would be no surface occupancy at select WTG positions to reduce the visual impacts of the proposed Project, as detailed in the following sub-alternatives.

- **Alternative D1: No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines**

  Alternative D1 would result in the exclusion of up to 21 WTG positions in Project 1 within 12 miles (19.3 kilometers) from shore. The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) above mean sea level (AMSL) and maximum blade tip height of 932 feet (284 meters) AMSL.

- **Alternative D2: No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines**

  Alternative D2 would result in the exclusion of up to 31 WTG positions in Project 1 that are sited closest to shore. The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.

- **Alternative D3: No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines**

  Alternative D3 would result in the exclusion of up to 6 WTG positions in Project 1 that are sited closest to shore. The remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.

ES.4.5 Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1

Under Alternative E, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to create a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback range between WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) and WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation.

There would be no surface occupancy along the southern boundary of the Atlantic Shores South Lease Area through the exclusion or micrositing of up to 4 to 5 WTG positions, or relocation of up to 4 to 5 WTG positions, or some combination of exclusion and relocation of WTG positions, to allow for a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) buffer between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area.

ES.4.6 Alternative F – Foundation Structures

Under Alternative F, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. This includes a range of foundation types (monopile and piled jacket, mono-bucket and suction bucket jacket, and gravity-based) to assess the extent of potential impacts of each foundation type for up to 211 foundations (inclusive of WTGs, OSSs, and 1 permanent met tower [Project 1]). This Final EIS analyzes the following:

- **Alternative F1**: **Piled Foundations**

  Under Alternative F1, the use of monopile and piled jacket foundations only is analyzed for the maximum extent of impacts.

- **Alternative F2: Suction Bucket Foundations**

  Under Alternative F2, the use of the mono-bucket, suction bucket jacket, and suction bucket tetrahedron base foundations only is analyzed for the maximum extent of impacts.

- **Alternative F3: Gravity-Based Foundations**

  Under Alternative F3, the use of gravity-pad tetrahedron and gravity-based structure (GBS) foundations only is analyzed for the maximum extent of impacts.

ES.4.7 Preferred Alternative

BOEM has identified Alternative B (Proposed Action), in combination with Alternative C4 (Habitat Impact Minimization/Fisheries Habitat Impact Minimization: Micrositing), Alternative D3 (No Surface Occupancy of Up to 10.8 Miles [17.4 Kilometers] from Shore: Removal of up to 6 Turbines), and Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1), as well as the two proposed mitigation measures that require WTG removal identified in Appendix G, Table G-3.

- BOEM-Proposed Mitigation Measure #5: No permanent structures will be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, met tower, and WTGs will be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.
- NOAA/NMFS-Proposed Mitigation Measure #1: Atlantic Shores must remove a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site).

The Preferred Alternative would include up to 195 WTGs[5] (between 105 and 130 WTGs for Project 1, and between 64 and 93 WTGs for Project 2), up to 10 OSSs (up to 5 in each Project), up to 1 permanent met tower (Project 1), and up to 4 temporary metocean buoys (up to 3 metocean buoys in Project 1; 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations and/or converter stations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations: Sea Girt and Atlantic City. All permanent structures must be located in the uniform grid spacing and the total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

The Preferred Alternative would require the proposed OSSs, met tower, and WTGs to be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart; remove a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site); microsite 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within the NMFS-identified AOC 1 and AOC 2; restrict the height of WTGs in Project 1 to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL; and provide

[5] 195 WTGs assumes that 197 total positions are available and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

a minimum 0.81-nautical mile (1,500-meter) setback between the WTGs in Atlantic Shores South and the WTGs in Ocean Wind 1 (Lease Area OCS-A 0498) by removing two WTGs and micrositing one WTG from Project 1.

The Preferred Alternative is identified to let the public know which alternative BOEM, as the lead agency, is leaning toward before an alternative is selected for action when a ROD is issued. No final agency action is being taken by the identification of the Preferred Alternative, and BOEM is not obligated to select the Preferred Alternative.

ES.5 Environmental Impacts

This Final EIS uses a four-level classification scheme to characterize the potential beneficial impacts and adverse impacts of alternatives as **negligible**, **minor**, **moderate**, or **major**. Resource-specific adverse and beneficial impact level definitions are presented in each resource section of Chapter 3, *Affected Environment and Environmental Consequences*.

BOEM analyzes the impacts of past and ongoing activities in the absence of the Project as the No Action Alternative. The No Action Alternative serves as the existing baseline against which all action alternatives are evaluated. BOEM also separately analyzes cumulative impacts of the No Action Alternative, which considers all other ongoing and reasonably foreseeable future activities described in Appendix D. In this analysis, the cumulative impacts of the No Action Alternative serve as the baseline against which the cumulative impacts of all action alternatives are evaluated. Table ES-2 summarizes the impacts of each alternative and the cumulative impacts of each alternative. Under the No Action Alternative, the environmental and socioeconomic impacts and benefits of the action alternatives would not occur.

NEPA implementing regulations (40 CFR 1502.16) require that an EIS evaluate the potential unavoidable adverse impacts associated with a proposed action. Adverse impacts that can be reduced by mitigation measures but not eliminated are considered unavoidable. The same regulations also require that an EIS review the potential impacts of irreversible or irretrievable commitments of resources resulting from implementation of a proposed action. Irreversible commitments occur when the primary or secondary impacts from the use of a resource either destroy the resource or preclude it from other uses. Irretrievable commitments occur when a resource is consumed to the extent that it cannot recover or be replaced.

Chapter 4, *Other Required Impact Analyses,* describes potential unavoidable adverse impacts. Most potential unavoidable adverse impacts associated with the Proposed Action would occur during the construction and installation phase and would be temporary. Chapter 4 also describes irreversible and irretrievable commitment of resources by resource area. The most notable of such commitments could include effects on habitat or individual members of protected species.

Appendix E, *Analysis of Incomplete and Unavailable Information* describes the incomplete or unavailable information that has been identified. BOEM considered whether the information was relevant to the assessment of impacts and essential to its analysis of alternatives based upon the resource analyzed.

Table ES-2. Summary and comparison of impacts among alternatives with no mitigation measures[6]

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.4.1 Air Quality							
Alternative Impacts[1]	Minor to moderate	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial
Cumulative Impacts[2]	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial	Minor to moderate; minor to moderate beneficial
3.4.2 Water Quality							
Alternative Impacts[1]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts[2]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.5.1 Bats							
Alternative Impacts[1]	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Cumulative Impacts[2]	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
3.5.2 Benthic Resources							
Alternative Impacts[1]	Moderate	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	F1: Moderate; moderate beneficial F2 and F3: Minor; minor beneficial	Moderate; moderate beneficial
Cumulative Impacts[2]	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial
3.5.3 Birds							
Alternative Impacts[1]	Minor	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
Cumulative Impacts[2]	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
3.5.4 Coastal Habitats and Fauna							
Alternative Impacts[1]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts[2]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.5.5 Finfish, Invertebrates, and Essential Fish Habitat							
Alternative Impacts[1]	Moderate	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
Cumulative Impacts[2]	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial

[6] All sub-alternatives were deemed to have similar impacts unless otherwise stated within the applicable column.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.5.6 Marine Mammals							
Incremental Impacts[3]	None	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds	Minor for NARW Minor to moderate for other mysticetes, odontocetes, and pinnipeds
Alternative Impacts[1]	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds
Cumulative Impacts[2]	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds	Major for NARW[4] Moderate for other mysticetes, odontocetes, and pinnipeds; minor beneficial for odontocetes and pinnipeds
3.5.7 Sea Turtles							
Alternative Impacts[1]	Minor	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts[2]	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
3.5.8 Wetlands							
Alternative Impacts[1]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts[2]	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.6.1 Commercial Fisheries and For-Hire Recreational Fishing							
Alternative Impacts[1]	Commercial fisheries: Major For-hire recreational fishing: Major	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial
Cumulative Impacts[2]	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial	Commercial fisheries: Major For-hire recreational fishing: Major; minor beneficial
3.6.2 Cultural Resources							
Alternative Impacts[1]	Moderate	Major	Major	Major	Major	Major	Major
Cumulative Impacts[2]	Major	Major	Major	Major	Major	Major	Major
3.6.3 Demographics, Employment, and Economics							
Alternative Impacts[1]	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts[2]	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.6.4 Environmental Justice							
Alternative Impacts[1]	Minor	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
Cumulative Impacts[2]	Moderate; minor beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial
3.6.5 Land Use and Coastal Infrastructure							
Alternative Impacts[1]	Minor; minor beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial
Cumulative Impacts[2]	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial	Minor; major beneficial
3.6.6 Navigation and Vessel Traffic							
Alternative Impacts[1]	Moderate	Major	Major	Major	Major	Major	Moderate
Cumulative Impacts[2]	Moderate	Major	Major	Major	Major	Major	Moderate
3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)							
Alternative Impacts[1]	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor
	Military and national security uses: Minor	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Moderate	Military and national security uses: Major	Military and national security uses: Moderate
	Aviation and air traffic: Negligible	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor
	Cables and pipelines: Negligible	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor
	Radar systems: Negligible	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate
	Scientific research and surveys: Moderate	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major
Cumulative Impacts[2]	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor	Marine mineral extraction: Minor
	Military and national security uses: Moderate	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Major	Military and national security uses: Moderate	Military and national security uses: Major	Military and national security uses: Moderate
	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor	Aviation and air traffic: Minor
	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor	Cables and pipelines: Minor
	Radar systems: Minor	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate	Radar systems: Moderate
	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major	Scientific research and surveys: Major
3.6.8 Recreation and Tourism							
Alternative Impacts[1]	Minor	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts[2]	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.6.9 Scenic and Visual Resources							
Alternative Impacts[1]	Major	Major	Major	Major	Major	Major	Major
Cumulative Impacts[2]	Major	Major	Major	Major	Major	Major	Major

Impact rating colors are as follows: orange = major; yellow = moderate; green = minor; light green = negligible or beneficial to any degree.
All impact levels are assumed to be adverse unless otherwise specified as beneficial. Where impacts are presented as multiple levels, the color representing the most adverse level of impact has been applied.
[1] Alternative impacts are inclusive of baseline conditions and impacts from ongoing activities for each resource as described in their respective sections in Chapter 3, *Affected Environment and Environmental Consequences*.
[2] Cumulative impacts represent alternative impacts (with the baseline) plus other foreseeable future impacts.
[3] Incremental impacts (i.e., alternative impacts without the baseline) were included at NMFS' request in order to support determinations under the Marine Mammal Protection Act.
[4] Impacts were assessed as major for the No Action Alternative and Proposed Action scenarios for North Atlantic right whale (NARW) because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species due to their low population numbers and continued state of decline.

Chapter 2

Alternatives

This chapter: (1) describes the alternatives carried forward for detailed analysis in this Final EIS, including the No Action, Proposed Action, and other action alternatives; (2) describes the non-routine activities and low-probability events that could occur during construction, O&M, and conceptual decommissioning of the proposed Atlantic Shores South Project; and (3) presents a summary and comparison of impacts between alternatives and resources affected.

2.1 Alternatives Analyzed in Detail

BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. Alternatives were reviewed using BOEM's screening criteria, presented in Section 2.2, *Alternatives Considered but Not Analyzed in Detail*. Alternatives that did not meet the screening criteria (i.e., were found to be infeasible or did not meet the purpose and need) were dismissed from detailed analysis in the EIS. The alternatives carried forward for detailed analysis in this Final EIS are summarized in Table 2-1 and described in detail in Sections 2.1.2 through 2.1.6. Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Section 2.2.

Although BOEM's authority under the OCSLA extends only to authorization of activities on the OCS, alternatives related to addressing nearshore and onshore elements as well as offshore elements of the Proposed Action are analyzed in the Final EIS. BOEM's regulations (30 CFR 585.620) require that the COP describe all planned facilities that the lessee would construct and use for the Project, including onshore and support facilities and all anticipated easements. As a result, those federal, state, and local agencies with jurisdiction over nearshore and onshore impacts could adopt, at their discretion, those portions of BOEM's EIS that support their own permitting decisions.

The alternatives listed in Table 2-1 are not mutually exclusive. BOEM may "mix and match" multiple listed EIS alternatives or sub-alternatives, to result in the Preferred Alternative identified in Section 2.1.7 of this Final EIS, provided that: (1) the design parameters are compatible, (2) the Preferred Alternative still meets the purpose and need, and (3) the Preferred Alternative does not exceed the PDE. The number of WTGs that could be removed may be reduced if an alternative is selected and combined with another alternative that requires removal of additional WTG positions and, if that combination of alternatives would fail to meet the purpose and need, including any awarded offtake agreement(s). The offtake agreements (PPAs or ORECs) are awarded by the state and subject to the state's determination and processes as to whether a separate environmental review is warranted.

NMFS and USACE are serving as cooperating agencies and intend to adopt the Final EIS if they deem it sufficient, after an independent review and analysis, to meet their NEPA compliance requirements. Under the Proposed Action and other action alternatives, NMFS' action alternative is to issue the requested Letter of Authorization (LOA) to the Applicant to authorize incidental take for the activities specified in its application and that are being analyzed by BOEM in the reasonable range of alternatives described here. USACE is required to analyze alternatives to the proposed Atlantic Shores South Project to satisfy NEPA and the CWA 404(b)(1) Guidelines. The analysis in this Final EIS considers a reasonable range of alternatives, including cable route options within the PDE and alternatives considered but dismissed.

BOEM decided to use the NEPA substitution process for National Historic Preservation Act (NHPA) Section 106 purposes, in accordance with 36 CFR 800.8(c), during its review of the Project. Section 106 of the NHPA regulations, “Protection of Historic Properties” (36 CFR Part 800), provides for use of the NEPA substitution process to fulfill a federal agency’s NHPA Section 106 review obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6. Avoidance, minimization, and mitigation measures to resolve adverse effects on historic properties are presented in Appendix G, *Mitigation and Monitoring*, and Appendix I, *Finding of Adverse Effect for the Atlantic Shores Offshore Wind South Project Construction and Operation Plan,* which includes the Section 106 Memorandum of Agreement (MOA) in Attachment A. Ongoing consultation with consulting parties may result in additional measures or changes to these measures. The Section 106 MOA documenting final avoidance, minimization, and mitigation measures to resolve adverse effects on historic properties will be executed prior to issuance of the ROD.

The Proposed Action is developed based on a PDE as described in the COP, and explained in Section 1.5, *Methodology for Assessing the Project Design Envelope*, and Appendix C.

Table 2-1. Alternatives considered for analysis

Alternative	Description
Alternative A – No Action	Under Alternative A, BOEM would not approve the COP, the Project’s construction and installation, O&M, and eventual decommissioning would not occur, and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization to the applicant under the MMPA. The current resource conditions, trends, and effects from ongoing activities under the No Action Alternative serve as the existing baseline against which all action alternatives are evaluated. Over the life of the proposed Project, other reasonably foreseeable future impact-producing offshore wind and non-offshore wind activities are expected to occur, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable future activities described in Appendix D, *Ongoing and Planned Activities Scenario,* without the Proposed Action serves as the baseline for the evaluation of cumulative impacts.
Alternative B – Proposed Action	Under Alternative B (Figure 2.1-1), the construction and installation, O&M, and eventual decommissioning of the Atlantic Shores South Project, which consists of two wind energy facilities (Project 1 and Project 2) on the OCS offshore of New Jersey, would be built within the range of the design parameters outlined in the Atlantic Shores South COP (Atlantic Shores 2024), subject to applicable mitigation measures. The Atlantic Shores South Project would include up to 200 total WTGs (between 105 and 136 WTGs for Project 1, and between 64 and 95 WTGs for Project 2), up to 10 OSSs (up to 5 in each Project), up to 1 permanent met tower, and up to 4 temporary meteorological and

Alternative	Description
	oceanographic (metocean) buoys (up to 1 met tower and 3 metocean buoys in Project 1, and 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations, 1 O&M facility, and up to 8 transmission cables making landfall at 2 New Jersey locations. The proposed landfall locations are the Monmouth landfall in Sea Girt, New Jersey with an onshore route to the existing Larrabee Substation POI and the Atlantic landfall in Atlantic City, New Jersey, with an onshore route to the existing Cardiff Substation, which would be upgraded to accommodate the Project's POI. Project 1 would have a capacity of 1,510 MW. Project 2's capacity is not yet determined, but Atlantic Shores has a goal of 1,327 MW, which would align with the interconnection service agreement Atlantic Shores intends to execute for both projects with the RTO, PJM.[1]
Alternative C – Habitat Impact Minimization/Fisheries Habitat Impact Minimization[2]	Under Alternative C, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, the layout and maximum number of WTGs and OSSs would be adjusted to avoid and minimize potential impacts on important habitats. NMFS identified two areas of concern (AOCs) within the Lease Area that have pronounced bottom features and produce habitat value. AOC 1 is part of a designated recreational fishing area called "Lobster Hole." AOC 2 is part of a sand ridge (ridge and trough) complex. • **Alternative C1: Lobster Hole Avoidance** (Figure 2.1-8) Up to 16 WTGs, 1 OSS, and associated interarray cables within the Lobster Hole designated area as identified by NMFS would be removed. • **Alternative C2: Sand Ridge Complex Avoidance** (Figure 2.1-9) Up to 13 WTGs and associated interarray cables within the NMFS-identified sand ridge complex would be removed. • **Alternative C3: Demarcated Sand Ridge Complex Avoidance** (Figure 2.1-10) Up to 6 WTGs and associated interarray cables within 1,000 feet (305 meters) of the sand ridge complex area identified by NMFS, but further demarcated through the use of the NOAA's Benthic Terrain Modeler and bathymetry data provided by Atlantic Shores, would be removed. • **Alternative C4: Micrositing** This alternative consists of micrositing 29 WTGs, 1 OSS, and associated interarray cables outside of 1,000-foot (305-meter) buffers of ridges and swales within AOC 1 and AOC 2.
Alternative D – No Surface Occupancy at Select Locations to Reduce Visual Impacts[2]	Under Alternative D, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, the no

[1] Atlantic Shores plans to enter into interconnection service agreements and interconnection construction service agreements with PJM to fund improvements to the onshore Cardiff and Larrabee substations, along with required grid updates. These agreements are distinct from PPAs (applicable in Connecticut, Massachusetts, and Rhode Island) and ORECs (applicable in Maryland, New Jersey, and New York). An OREC represents the environmental attributes of one MWh of electric generation from an offshore wind project. BPU awards ORECs through a competitive bidding process and they represent a long-term contract with the State of New Jersey.

[2] The number of WTGs that could be removed may be reduced if this alternative is selected and combined with another alternative that requires removal of additional WTG positions, and if that combination of alternatives would fail to meet the purpose and need, including any awarded offtake agreement(s).

Alternative	Description
	surface occupancy would occur at select WTG positions to reduce the visual impacts of the proposed Project. • **Alternative D1: No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines** (Figure 2.1-11) This alternative would exclude placement of WTGs up to 12 miles (19.3 kilometers) from shore, resulting in the removal of up to 21 WTGs from Project 1 and associated interarray cables. The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) above mean sea level (AMSL) and maximum blade tip height of 932 feet (284 meters) AMSL. • **Alternative D2: No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines** (Figure 2.1-12) The up to 31 WTGs sited closest to shore would be removed, as well as the associated interarray cables. The remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL. • **Alternative D3: No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines** (Figure 2.1-13) The up to 6 WTGs sited closest to shore would be removed, as well as the associated interarray cables. The remaining WTGs in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.
Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1[2]	Under Alternative E (Figure 2.1-14), the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to create a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback range between WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) and WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation. There would be no surface occupancy along the southern boundary of the Atlantic Shores South Lease Area through the exclusion or micrositing of up to 4 to 5 WTG positions to allow for a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) separation between WTGs in the Atlantic Shores South Lease Area and WTGs in the Ocean Wind 1 Lease Area.
Alternative F – Foundation Structures	Under Alternative F, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. This includes a range of foundation types (of monopile and piled jacket, suction bucket, and gravity-based). To assess the extent of potential impacts of each foundation type for up to 211 foundations (inclusive of WTGs, OSSs, and 1 permanent met tower [Project 1]), this Final EIS analyzes the following: • **Alternative F1: Piled Foundations** The use of monopile and piled jacket foundations only is analyzed for the maximum extent of impacts. • **Alternative F2: Suction Bucket Foundations**

Alternative	Description
	The use of the mono-bucket, suction bucket jacket, and suction bucket tetrahedron base foundations only is analyzed for the maximum extent of impacts. • **Alternative F3: Gravity-Based Foundations** The use of gravity-pad tetrahedron and gravity-based structure foundations only is analyzed for the maximum extent of impacts.
Preferred Alternative	Under the Preferred Alternative, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore New Jersey would occur within the range of design parameters outlined in the COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to require the proposed OSSs, met tower, and WTGs to be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart; remove a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site); microsite 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within the NMFS-identified AOC 1 and AOC 2, restrict the height of WTGs in Project 1 to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL, and provide a minimum 0.81-nautical mile (1,500-meter) setback between the WTGs in Atlantic Shores South and the WTGs in Ocean Wind 1 (Lease Area OCS-A 0498) by removing two WTGs and micrositing one WTG from Project 1.

2.1.1 Alternative A – No Action

Under the No Action Alternative, BOEM would not approve the COP. The Atlantic Shores South Project's construction and installation, O&M, and eventual decommissioning would not occur, and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization to the applicant under the MMPA. The current resource conditions, trends, and effects from ongoing activities under the No Action Alternative serve as the existing baseline against which all direct and indirect impacts from action alternatives are evaluated.

Over the life of the proposed Project, other reasonably foreseeable future impact-producing offshore wind and non-offshore wind activities are expected to occur, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable planned activities described in Appendix D, *Ongoing and Planned Activities Scenario*, without the Proposed Action, serves as the future baseline for the evaluation of cumulative impacts.

2.1.2 Alternative B – Proposed Action

Under the Proposed Action, the construction and installation, O&M, and eventual decommissioning of two wind energy facilities (Project 1 and Project 2) on the OCS offshore of New Jersey would occur within the range of design parameters outlined in Volume I of the COP (Atlantic Shores 2024), which are summarized in Appendix C, *Project Design Envelope and Maximum-Case Scenario.* Project 1 would have a capacity of 1,510 MW. Project 2's capacity has not yet been determined. Atlantic Shores has a goal of 1,327 MW for Project 2, which would align with the interconnection service agreement it intends to execute for both projects with the RTO, PJM.[3] A description of construction and installation, O&M, and decommissioning activities to be undertaken for the Proposed Action is included in Sections 2.1.2.1 through 2.1.2.3. Refer to Volume I of the COP (Atlantic Shores 2024) for additional details on the Project's design.

[3] Atlantic Shores plans to enter into interconnection service agreements and interconnection construction service agreements with PJM to fund improvements to the onshore Cardiff and Larrabee substations, along with required grid updates. These agreements are distinct from PPAs (applicable in Connecticut, Massachusetts, and Rhode Island) and ORECs (applicable in Maryland, New Jersey, and New York). An OREC represents the environmental attributes of one MWh of electric generation from an offshore wind project. BPU awards ORECs through a competitive bidding process and they represent a long-term contract with the State of New Jersey.

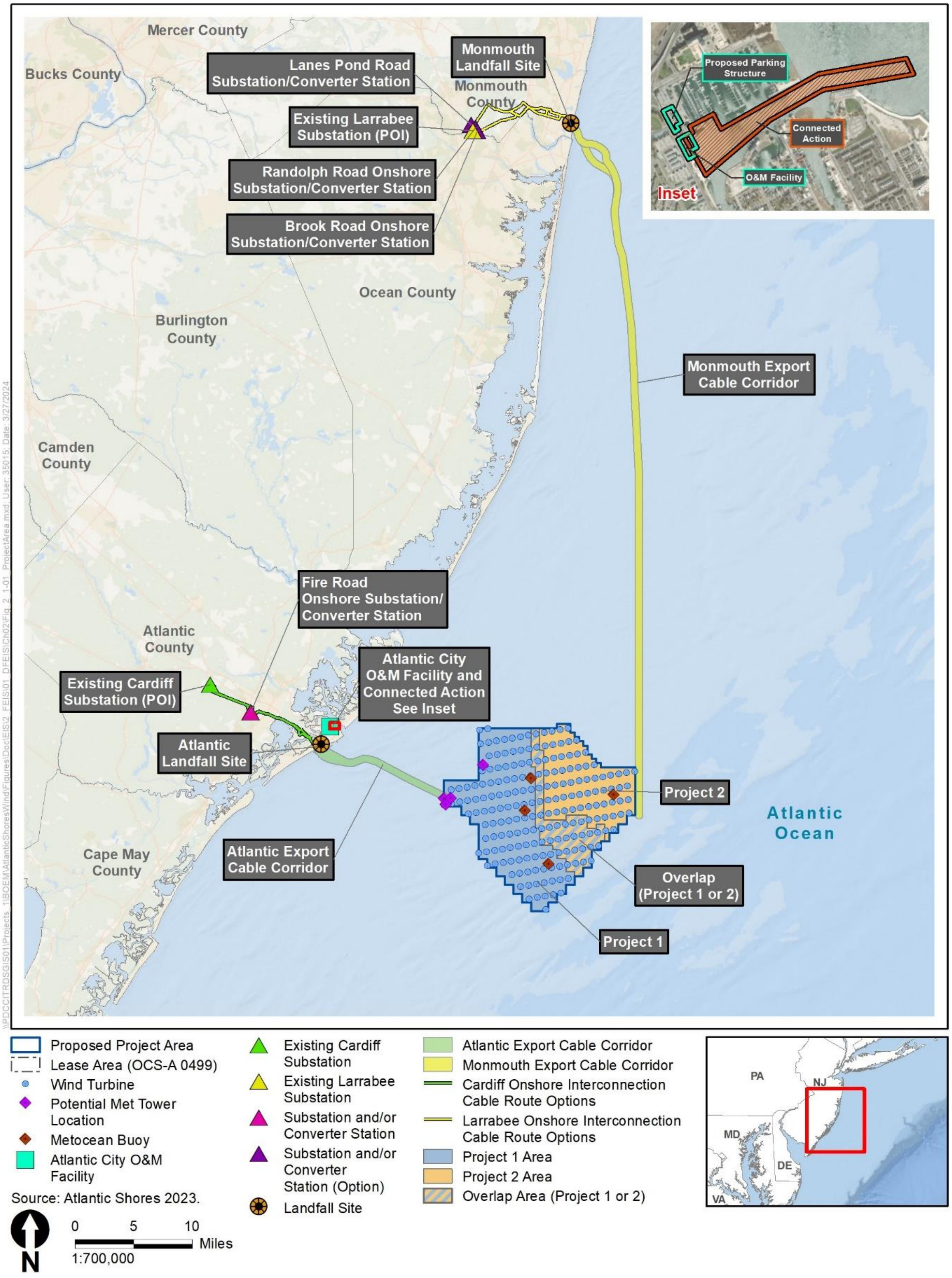


Figure 2.1-1. Atlantic Shores South Offshore Wind Project

Atlantic Shores has committed to environmental protection measures (EPMs) as part of its Proposed Action to avoid, minimize, and otherwise mitigate impacts on physical, biological, socioeconomic, and cultural resources (summarized at the end of each section of COP Volume II; Atlantic Shores 2024). These measures are described in Appendix G and are incorporated as part of the Proposed Action and applicable action alternatives in this Final EIS. Consultations and authorizations under the MMPA, Section 7 of the ESA, the MSA, and Coastal Zone Management Act (CZMA), as well as the submission of applications for and issuance of other necessary permits and authorizations under applicable statutes and regulations, may result in additional measures or changes to these measures.

Atlantic Shores has also committed to comprehensive monitoring of fisheries and benthic habitat conditions throughout the phases of the Project's life-cycle. These monitoring activities will document baseline environmental conditions relevant to fisheries and benthic resources in the WTA, and monitoring of those conditions will continue throughout construction and installation, O&M, and decommissioning of the Proposed Action. These surveys will allow Atlantic Shores to measure Project-related disturbances and monitor the recovery of habitats and biological communities. Atlantic Shores' Fisheries Monitoring Plan will utilize survey gear including clam dredges, demersal fish trawls, and fish traps/pots. Benthic monitoring surveys will utilize gear types including benthic grab samplers, multibeam echosounders, and underwater video cameras.

2.1.2.1 Construction and Installation

The Proposed Action would include the construction and installation of both onshore and offshore facilities. Construction and installation is expected to begin in 2024 and be completed in 2028. Atlantic Shores anticipates initiating land-based construction before beginning the construction of offshore components. The construction of Project 1 and Project 2 would follow a similar schedule up until the activity of WTG Installation and Commissioning. An anticipated Proposed Action schedule is summarized in Table 2-2.

Table 2-2. Anticipated Proposed Action construction schedule

Activity	Expected Timeframe	
	Project 1	Project 2
Onshore Interconnection Cable Installation	2025–2027	
Onshore Substation and/or Converter Station Construction	2025–2028	
Cofferdam Installation and Removal	2025–2026	
Export Cable Installation	2027–2028	
OSS Installation and Commissioning	2026–2027	
WTG Foundation Installation	2026–2028	
Interarray Cable Installation	2026–2028	
WTG Installation and Commissioning	2026–2027	2028

Source: COP Volume I, Chapter 4, Table 4.1.1; Atlantic Shores 2024.

Construction of the Proposed Action is anticipated to begin with the installation of onshore interconnection cables and construction of onshore substations and/or converter stations. Temporary cofferdams are expected to be installed prior to export cable installation. Construction of the offshore facilities is expected to begin with installation of the export cables and the WTG and OSS foundations (including scour foundation). Once the OSS foundations are installed, the topsides can be installed and commissioned, and the interlink cables (if used) can be installed. At each WTG position, after the foundation is installed, the associated interarray cables and WTGs can be installed. Given the number of WTG and OSS positions, there is expected to be considerable overlap in the various equipment installation periods. Installation of the Atlantic Shores South Project's onshore and offshore facilities may occur over a period of up to 4 years (to accommodate weather or seasonal work restrictions); offshore construction is expected to last approximately 3 years, with the exception of high resolution geophysical and geotechnical (G&G) surveys, which are expected to last 5 years. The surveys would be conducted prior to offshore construction commencing and would continue throughout Project construction. In addition, geophysical surveys would be conducted post-construction to ensure proper installation of the Project components.

Onshore Activities and Facilities

Proposed Onshore Project elements include the landfall sites for the submarine export cables, onshore export cable routes, onshore substations (if high-voltage alternating current [HVAC] export cables are used) and/or converter stations (if high-voltage direct current [HVDC] export cables are used), and the interconnection cables linking the onshore substations and/or converter stations to the POIs to the existing grid. Appendix C describes the PDE for onshore activities and facilities, and the COP Volume I provides additional details on construction and installation methods (Atlantic Shores 2024). These onshore elements of the Proposed Action are included in BOEM's analysis in this Final EIS to support the analysis of a complete Project; however, BOEM's authority under the OCSLA extends only to the activities on the OCS.

The Atlantic Landfall Site for the submarine Atlantic Export Cable Corridor (ECC), would be located in Atlantic City, New Jersey on a site currently consisting of a paved public parking lot. The proposed landfall site is located at the eastern terminus of South California Avenue adjacent to the Atlantic City Boardwalk. The site is bounded by Pacific, South Belmont, and South California Avenues and is owned by Atlantic Shores. Export cables may also make landfall within the roadway on South Iowa Avenue, located one block southeast of the parcel adjacent to South California Avenue. Both landfall locations are shown on Figure 2.1-2 as the Atlantic Landfall Site. The landfall site would include underground transition vaults associated with the Atlantic export cables (one vault per cable export). An offset would be instituted around an existing outfall pipe at the proposed location.

The landfall would be connected to the approximately 12.4- to 22.6-mile (20.0- to 36.4-kilometer) Cardiff Onshore Interconnection Cable Route that would continue northwest under urban residential, commercial, and industrial areas to the potential site for the Cardiff Substation and/or Converter Station and terminate at the Cardiff Substation, owned by Atlantic City Electric (ACE). The potential substation and/or converter station site, shown on Figure 2.1-2, is a vacant lot located in Egg Harbor Township, approximately 20 acres (8 hectares) in size and bordered by Fire Road (County Road 651) to the north and Hingston Avenue to the south.

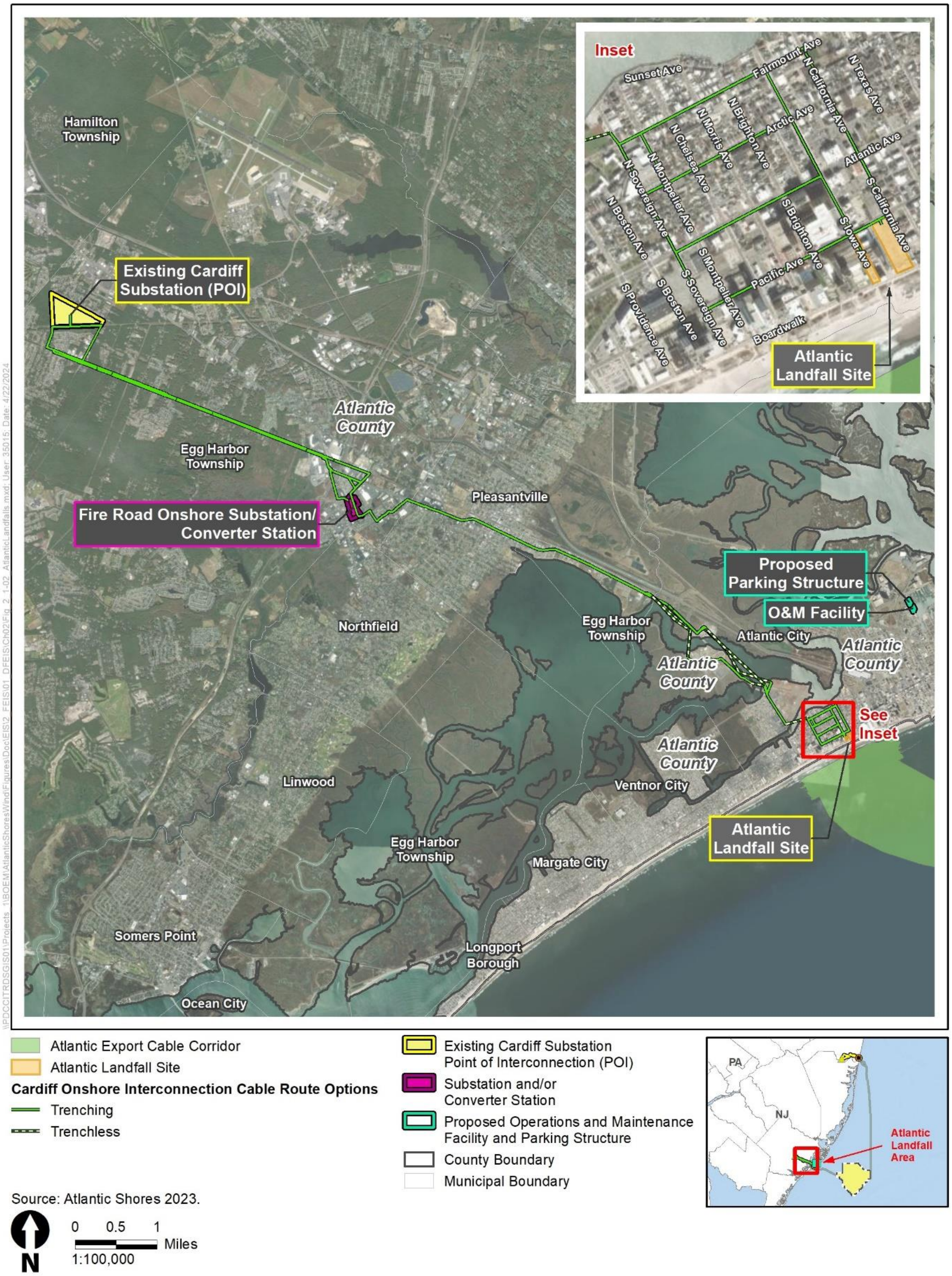


Figure 2.1-2. Onshore Project elements: Atlantic Landfall Site to Cardiff Substation POI

The onshore substation and/or converter station would contain transformers and other electrical gear, and the transmission voltage would be increased or decreased in preparation for grid interconnection at the Cardiff Substation POI. Modifications to the substation would be required to accommodate the interconnection of the Atlantic Shores South Project. Upgrades would be contained on ACE's property and would include expanding the existing substation by building new 230-kilovolt (kV) gas-insulated switchgear equipment. Atlantic Shores would support the construction of the new equipment on behalf of ACE. The substation would remain an asset owned, maintained, and operated by ACE.

If construction of the cable landings is to occur during a scheduled state and/or federal beach nourishment project, Atlantic Shores would coordinate with the New Jersey Department of Environmental Protection (NJDEP), Office of Coastal Engineering and USACE.

The Monmouth Landfall Site for the submarine Monmouth ECC would be located in Sea Girt, New Jersey, at the U.S. Army National Guard Training Center (NGTC), as seen on Figure 2.1-3. The underground transition vaults (one per export cable) would be located in the southeast corner of the NGTC property in a previously disturbed area. This area currently serves as a staging and access location for a federal beach nourishment project, and, as such, Atlantic Shores would coordinate all planned activities at this location with USACE and NJDEP, Office of Coastal Engineering. The landfall would be connected to the approximately 9.8- to 23.0-mile (15.8- to 37.0-kilometer) Larrabee Onshore Interconnection Cable Route, which would continue west to one of three potential sites for the Larrabee Substation and/or Converter Station and terminate at the Larrabee Substation POI owned by Jersey Central Power & Light (JCP&L). The three potential substation and/or converter station sites, shown on Figure 2.1-3, are the approximately 16.3-acre (6.6-hectare) Lanes Pond Road Site, located at the southeast intersection of Lanes Pond Road and Miller Road; the approximately 24.6-acre (10-hectare) Randolph Road Site, located east of Lakewood Farmingdale Road and north of Randolph Road; and the approximately 99.4-acre (40.2-hectare) Brook Road Site, located west of Brook Road and south of Randolph Road.[4] All three sites are located in Howell Township, New Jersey.

The PDE includes the proposed onshore substation and/or converter stations and cable routes as options, and therefore, will be analyzed collectively as part of the Proposed Action. However, the Brook Road Site is expected to be prepared and developed as part of the State of New Jersey's State Agreement Approach (SAA) to support multiple offshore wind generation projects that the state will procure in the future.[5] New Jersey's third offshore solicitation requires bidders to utilize the state's transmission provider and their infrastructure (to be developed by the SAA-awardee) in their bids. If Atlantic Shores receives the award on behalf of the Atlantic Shores South Project, Atlantic Shores will route to the SAA-awardee's prepared site (the Brook Road Site).

---

[4] New Jersey's Third Solicitation for Offshore Wind Renewable Energy Certificates (OREC), released March 6, 2023, https://www.nj.gov/bpu/pdf/boardorders/2023/20230306/8D%20ORDER%20OSW%20Third%20Solicitation.pdf.
[5] PJM State Agreement Approach: New Jersey's 2021 Offshore Wind Transmission Competitive Solicitation under PJM State Agreement Approach, https://www.nj.gov/bpu/about/divisions/ferc/saa.html.

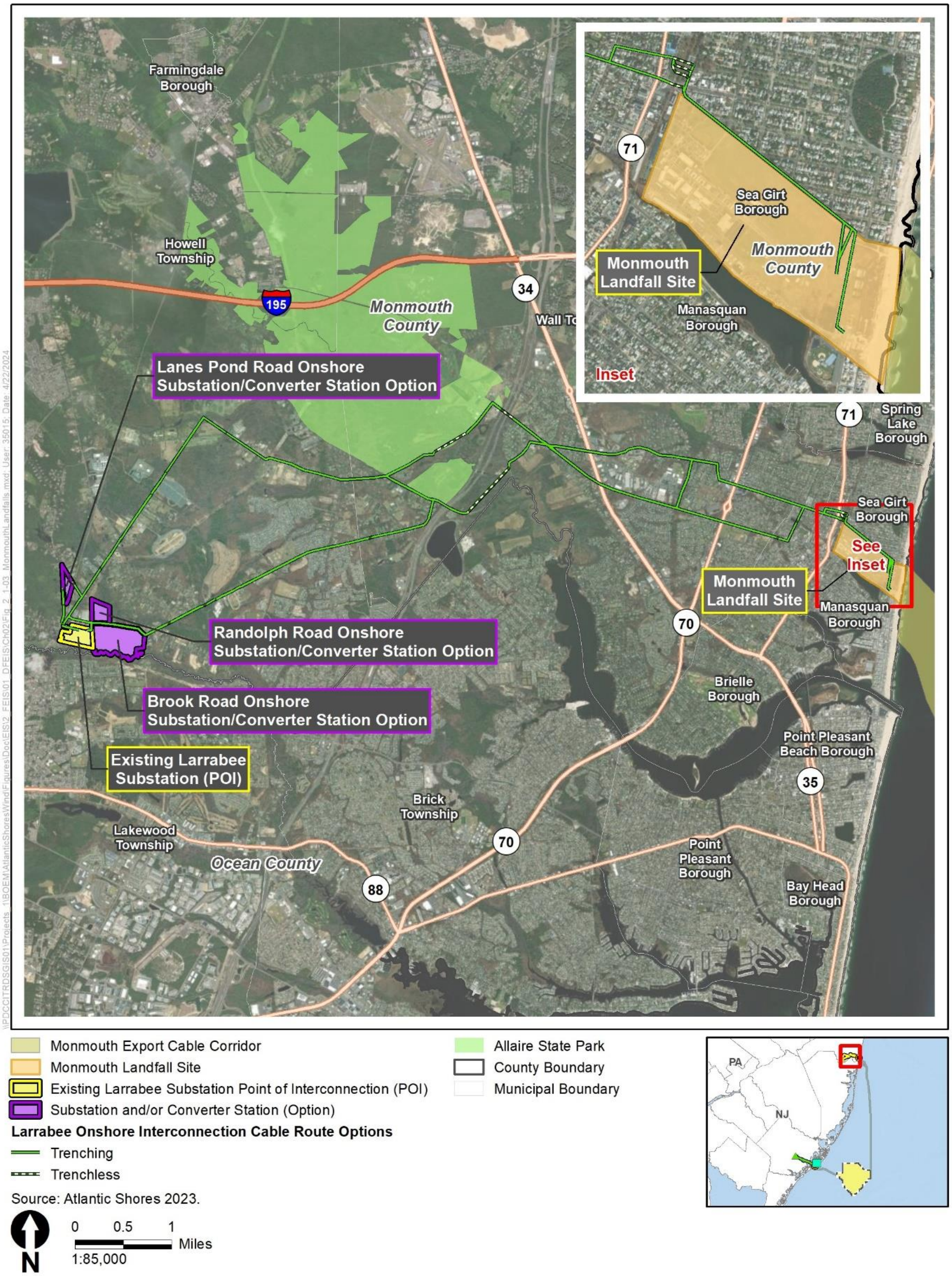


Figure 2.1-3. Onshore Project elements: Monmouth Landfall Site to Larrabee Substation POI

All siting, environmental review, permitting, and other preparation activities at the Brook Road Site are to be completed by the SAA-awardee (or the designated lead state or federal agency, as appropriate) and are thereby not included in the environmental analysis of this Final EIS, except as part of the cumulative impacts analysis. If Atlantic Shores does not receive the award to utilize the Brook Road Site, Atlantic Shores will utilize either the Lanes Pond Road Site or the Randolph Road Site. Additional details regarding the state's development of the Brook Road Site can be found in Appendix D, Table D-8.

The onshore substation and/or converter station would contain transformers and other electrical gear, and the transmission voltage would be increased or decreased in preparation for grid interconnection at the existing Larrabee Substation POI. Modifications to the POI would be required to accommodate the interconnection of the Atlantic Shores South Project. The scope of the modifications is expected to include upgrading the existing substation by adding an additional breaker bay(s). JCP&L would be responsible for the design and construction of the required upgrades on the existing electrical grid, including the upgrades to the Larrabee Substation.

The onshore interconnection cables would be contained within buried concrete duct banks. The installation of the duct banks and encased cables within the cable routes would be completed via open trenching except in areas where resources are present and need to be avoided. Both the Cardiff and Larrabee Onshore Interconnection Cable Routes include several wetland and waterway crossings. Techniques such as horizontal directional drilling (HDD), pipe jacking, or jack-and-bore methodologies would be utilized to avoid direct surface disturbance. Atlantic Shores is coordinating with USACE to ensure the proposed HDD depth and distance would meet USACE requirements.

To support construction of the Cardiff Onshore Interconnection Cable Route and Larrabee Onshore Interconnection Cable Route, a Traffic Management Plan (TMP) would be developed to avoid and minimize traffic impacts and would adhere to seasonal construction restrictions near the shoreline. Subject to ongoing coordination with local authorities, no onshore construction would occur during the summer (generally Memorial Day to Labor Day) for the Cardiff Onshore Interconnection Cable Route and a portion of the Larrabee Onshore Interconnection Cable Route.

Offshore Activities and Facilities

Proposed Offshore Project components include up to 200 WTGs and their foundations, up to 10 OSSs and their foundations, up to 1 permanent met tower and its foundation, scour protection for foundations, interarray cables and offshore export cables, and up to 4 temporary metocean buoys (these elements collectively compose the Offshore Project area). The proposed Offshore Project elements would be located on the OCS as defined in the OCSLA, except that a portion of the offshore export cables would be located within state waters (Figure 2.1-4). Appendix C describes the PDE for offshore activities and facilities, and COP Volume I, Section 4.0 provides additional details on construction and installation methods (Atlantic Shores 2024).

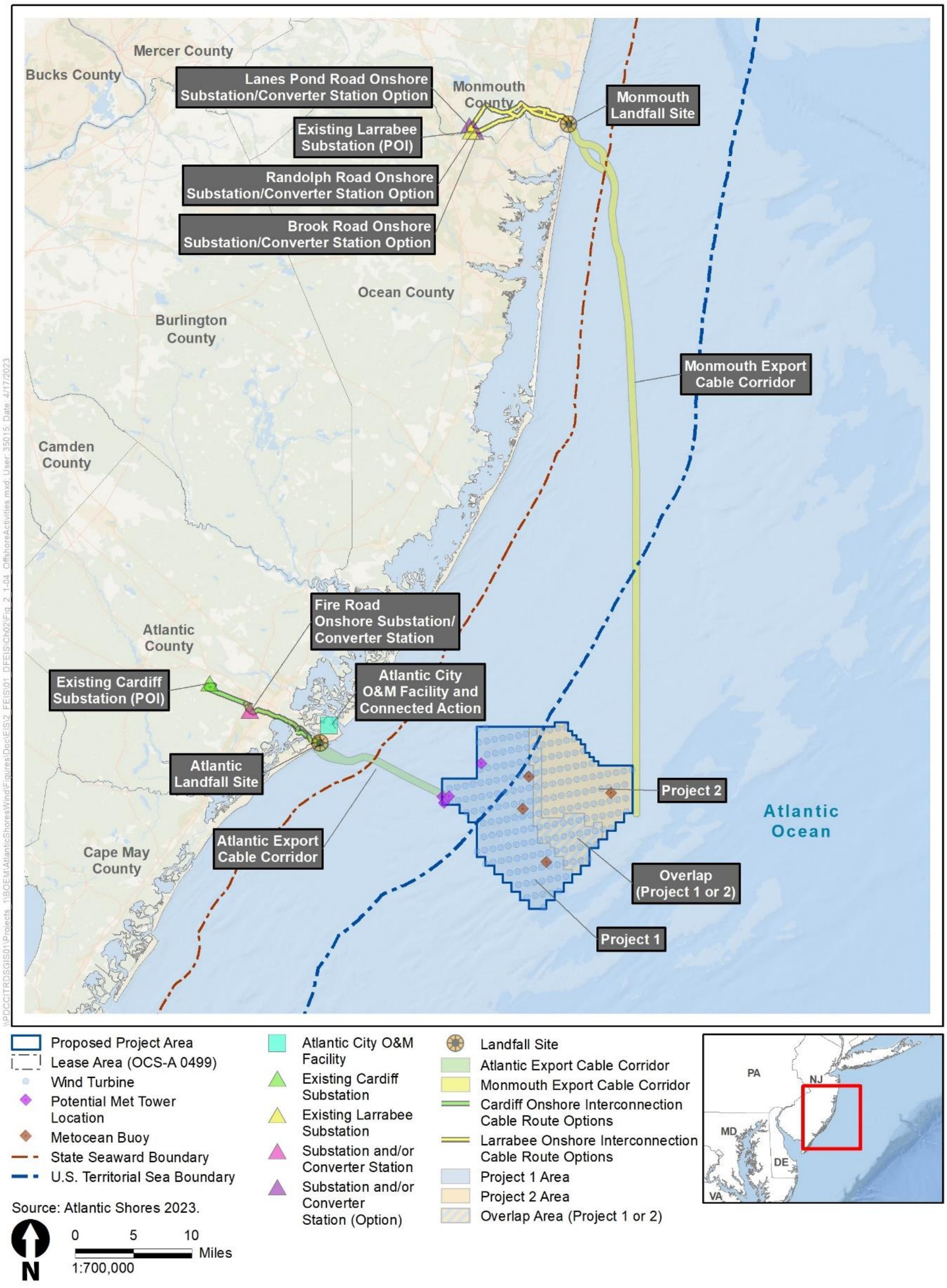
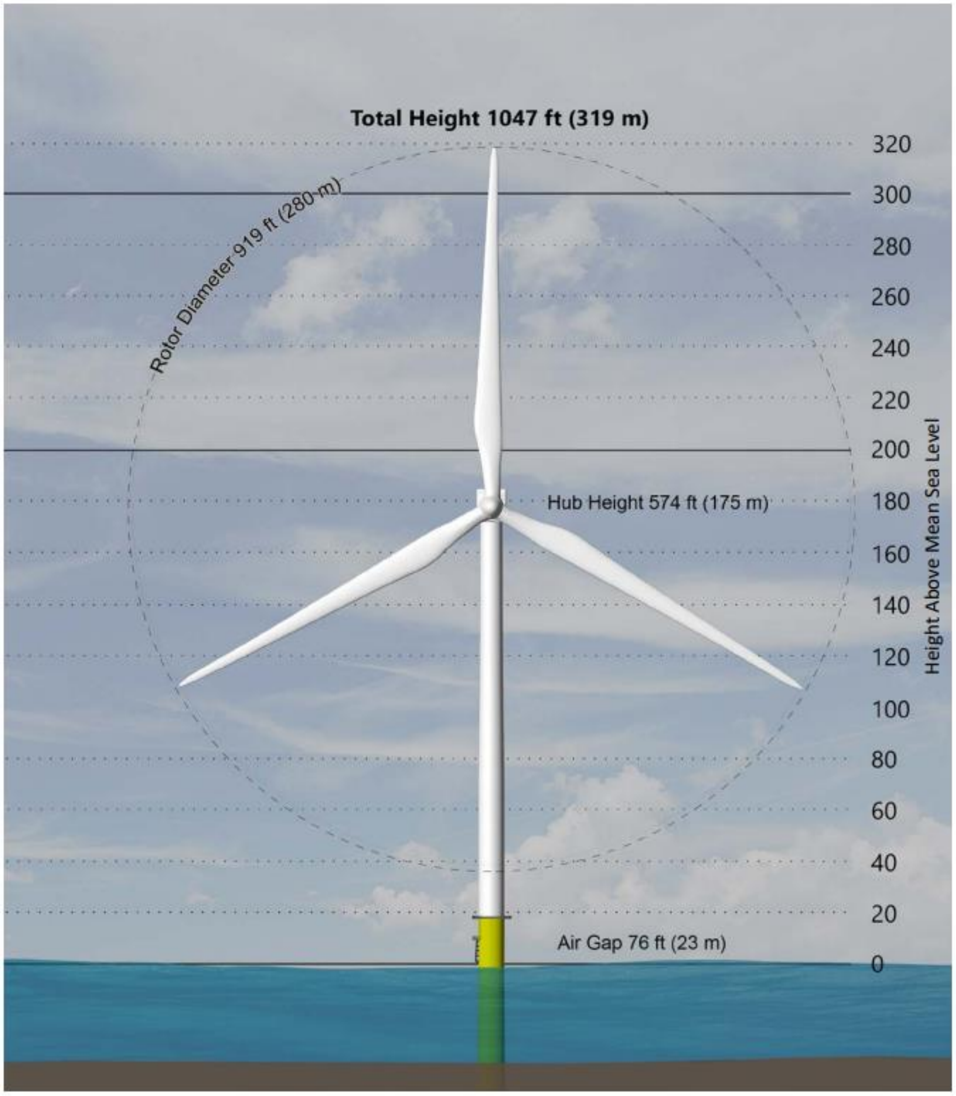


Figure 2.1-4. Offshore activities and facilities and state and U.S. territorial sea boundaries

Atlantic Shores proposes the installation of a maximum of 200 WTGs (inclusive of the 31 WTGs in the Overlap Area); this would include a minimum of 105 WTGs to a maximum of 136 WTGs for Project 1 and a minimum of 64 WTGs to a maximum of 95 WTGs for Project 2, within the approximately 102,124-acre (41,328-hectare) WTA. The WTGs would extend to a maximum height of up to approximately 1,046.6 feet (319.0 meters) AMSL. The WTG dimensions on Figure 2.1-5 are indicative of the maximum dimensions of WTGs anticipated to be commercially available within the Atlantic Shores South Project's expected development schedule. The WTGs would be placed in a uniform grid along east-northeast/west-southwest rows spaced 1.0 nautical mile (1.9 kilometers) apart and north/south columns spaced 0.6 nautical mile (1.1 kilometers) apart. Atlantic Shores would mount the WTGs on monopile foundations for Project 1 and monopile or piled jacket foundations for Project 2. All WTGs within each project would be on the same type of foundation (i.e., all monopile or all piled jacket foundations for WTGs in Project 2).



Source: Atlantic Shores 2024

Figure 2.1-5. Maximum wind turbine generator dimensions AMSL

Once the WTG dimensions have been established, Atlantic Shores will coordinate with the National Weather Service (NWS) to conduct a required analysis by the Radar Operations Center on potential data contamination for the NEXRAD Weather Surveillance Radar, 1988 Doppler (WSR-88D) and Federal Aviation Administration (FAA) Terminal Doppler Weather Radar (DWR). Offshore installation of WTGs would likely involve a jack-up WTG installation vessel assisted by feeder barges or jack-up feeder vessels.

The Atlantic Shores South Project would include up to 10 OSSs that would serve as common collection points for power from the WTGs as well as the origin for the export cables that deliver power to shore. Atlantic Shores is considering three sizes of OSS. Depending on the final OSS design, there would be up to ten small OSSs, up to five medium OSSs, or up to four large OSSs in Project 1 and Project 2 combined. The breakdown of OSSs per project can be found in Table 2-3. OSSs would be located along the same east-northeast/ west-southwest rows as the WTGs but sited within the north/south rows of the WTGs, as shown in Figure 2.1-6. This placement of permanent structures between the WTGs is referred to as "off-grid." Small OSSs would be located at least 12 miles (19.3 kilometers) from shore, whereas medium and large OSSs would be located at least 13.5 miles (21.7 kilometers) from shore. More information on installation can be found in COP Volume I, Section 4.4 (Atlantic Shores 2024).

Table 2-3. Types of OSS needed per project

Projects	Small OSS	Medium OSS	Large OSS
Project 1	Up to 5	Up to 2	Up to 2
Project 2	Up to 5	Up to 3	Up to 2

Source: COP Volume I, Section 4.1.1, Project Design Envelope Overview; Atlantic Shores 2024.

Atlantic Shores is planning to leave the option open to include one of three categories of OSS foundations: piled, suction bucket, or gravity-based foundations. The type of foundation would depend on the size of the OSS itself. The foundations for small OSSs would be piled (monopile or piled jacket) or suction bucket (suction bucket jacket). The foundations for medium or large OSSs would be piled (piled jacket), suction bucket (suction bucket jacket), or gravity-based structures (GBS). The breakdown of OSS foundation types can be found in Table 2-4 in Section 2.1.6, *Alternative F – Foundation Structures*. Power generated by the WTGs would be transmitted to the OSSs via 66 kV to 150 kV interarray cables, which would connect to circuit breakers and transformers located within the OSS topsides. These transformers would increase the voltage level to the export cable voltage (230 kV to 275 kV HVAC cables or 320 kV to 525 kV HVDC cables). From the OSSs, the export cables would transmit electricity to shore.

During construction and operation, the OSSs would be lighted and marked in accordance with FAA, U.S. Coast Guard (USCG), and BOEM guidelines to aid safe navigation within the WTA. Atlantic Shores does not currently anticipate installing helicopter pads on the OSSs, though this feature may be added depending on the O&M strategy employed. If a helicopter pad is installed, it would be designed to support a USCG helicopter, including appropriate lighting and marking as required.

Up to eight export cables would be installed to deliver electricity from the OSSs to the landfall sites. The export cables from each Project have the potential to utilize either ECC or be co-located in the same ECC. Both Project 1 and Project 2 would also include electrically distinct interarray cables to connect strings of WTGs to an OSS and may include interlink cables to connect OSSs to each other. Project 1 and

Project 2 would each include HVAC and/or HVDC export cables. If HVAC cables are used, the voltage would be between 230 kV and 275 kV; if HVDC cables are used, the voltage would be between 320 kV and 525 kV. Furthermore, if HVDC cables are used, it is anticipated that a closed-loop cooling system would be utilized, pending technical suitability and commercial availability of the technology.

Atlantic Shores proposes to construct separate submarine export cables, with approximately 328–820 feet (100–250 meters) between each cable, for Project 1 and Project 2 within the submarine ECCs identified in the COP and shown on Figure 2.1-1. The approximately 12-mile (19-kilometer) Atlantic ECC would travel from the western tip of the WTA westward to the Atlantic Landfall Site. The approximately 61-mile (98-kilometer) Monmouth ECC would travel north from the eastern corner of the WTA along the eastern edge of the Lease Area to the Monmouth Landfall Site.

The interarray and interlink cables could be installed using one or more of the following methods: simultaneous lay and burial, post-lay burial, or pre-lay trenching. Atlantic Shores is carefully evaluating available cable installation tools to select techniques that are appropriate for the site and that would maximize the likelihood of achieving the target cable burial depth of 5 to 6.6 feet (1.5 to 2.0 meters).

Most of the export, interarray, and interlink cables would be installed using jet trenching (either simultaneous lay and burial or post-lay burial) or jet plowing, with limited areas of mechanical trenching. It is estimated that 80 to 90 percent of the offshore cables would be installed with a single pass of the cable installation tool. However, in limited areas expected to be more challenging for cable burial (along up to 10 to 20 percent of the export, interarray, and interlink cable routes), an additional one to three passes of the cable installation tool may be required to further lower the cable to its target burial depth.

In areas where burial of the cables to the target depth (5 to 6.6 feet [1.5 to 2 meters]) is not feasible, cable protection would be installed on the seabed above the cable as a secondary measure to protect the cables. Proposed types of cable protection include the following:

- Rock placement: Up to three layers of rock, with rock size increasing in higher layers.
- Concrete mattresses: High-strength concrete blocks cast around mesh.
- Rock Bags: Rock-filled filter unit enclosed by polyester mesh.
- Grout-filled bags: Woven fabric filled with grout.
- Half-shell pipes: Composite materials or cast iron that is fixed around a cable.

The cables are proposed to be routed around federal aids to navigation (ATONs) where practical. However, where existing obstructions (such as artificial reefs and sand borrow areas) did not allow for avoidance, Atlantic Shores surveyed around the aids to navigation and will coordinate with USCG on potential repositioning of an aid to navigation.

The width of each ECC would correspond to the width of the surveyed corridors, in which the potential cable easements would be located, and would range from approximately 3,300 to 4,200 feet (1,000 to

1,280 meters) for all of the Monmouth ECC and most of the Atlantic ECC, though the Atlantic ECC widens to approximately 5,900 feet (1,800 meters) near the Atlantic Landfall Site. The proposed width of each ECC accommodates the planned export cable options as well as the associated cable installation vessel activities and would allow for avoidance of resources such as shipwrecks, artificial reefs, and sensitive habitats. Variations in width at the landfall sites are needed to accommodate the construction vessel activities necessary to support the landfall of each export cable via HDD. Up to eight temporary cofferdams, four at each landfall site, may be constructed. The cofferdams would be approximately 98.4 feet by 26.2 feet (30 meters by 8 meters). Following the installation of the HDD conduit and export cable, the seabed would be restored, and the cofferdam removed. Atlantic Shores would conduct vibration monitoring at the Atlantic Landfall Site during HDD activities to ensure minimal impacts to the existing outfall pipe at the proposed location.

Atlantic Shores would survey all cable crossings, and if a cable being crossed is active, Atlantic Shores would develop a crossing agreement with its owner. At each crossing, before installation, Atlantic Shores would clear the area around the crossing of any marine debris. Depending on the status of the existing cable and its location, such as burial depth and substrate characteristics, cable protection may be placed between the existing cable and Atlantic Shores' overlying cable. However, if sufficient vertical distance exists, such protection may be avoided. The presence of an existing cable may prevent Atlantic Shores' cable from being buried to its target burial depth. In this case, cable protection may be required on top of the proposed cable at the crossing location. Following installation of the proposed cables, Atlantic Shores would survey the cable crossing again. Additionally, Atlantic Shores is coordinating with Ocean Wind, LLC (Ocean Wind), the developer of the proposed neighboring Ocean Wind 1 Offshore Wind Farm Project (Ocean Wind 1) to develop a mutually acceptable crossing agreement to govern proposed cable crossings.

A single permanent met tower up to 590.6 feet (180 meters) AMSL may be installed within the WTA during construction of Project 1. Up to four locations for the met tower, all located within Project 1, are under consideration. All four potential locations (shown on Figures 2.1-4 and 2.1-6) fall outside of the WTG gridded layout pattern and are located on or near the western perimeter of the WTA so as to minimize potential interference with navigation, as shown in Figure 2.1-6. The met tower would not replace a WTG location. The foundation options for the met tower include piled (monopile or piled jacket), suction bucket (suction bucket jacket or mono-bucket), and GBS. The met tower would be composed of square lattice consisting of tubular steel and would be equipped with an approximately 50-foot by 50-foot (15-meter by 15-meter) deck.

Up to four metocean buoys (three for Project 1 and one for Project 2) may be installed within the WTA during construction. These buoys, shown in Figure 2.1-4, would be temporary and used to monitor weather and sea state conditions during construction. The buoys would be anchored to the seafloor using a steel chain connected to a steel chain weight and possibly an additional bottom weight associated with a water level sensor. Once construction is completed, the buoys would be decommissioned in accordance with 30 CFR Part 285, Subpart I.

Indicative locations of the up to ten small OSSs, up to five medium OSSs, and up to four large OSSs, as well as the four potential met tower locations and four metocean buoy locations are shown on Figure 2.1-6.

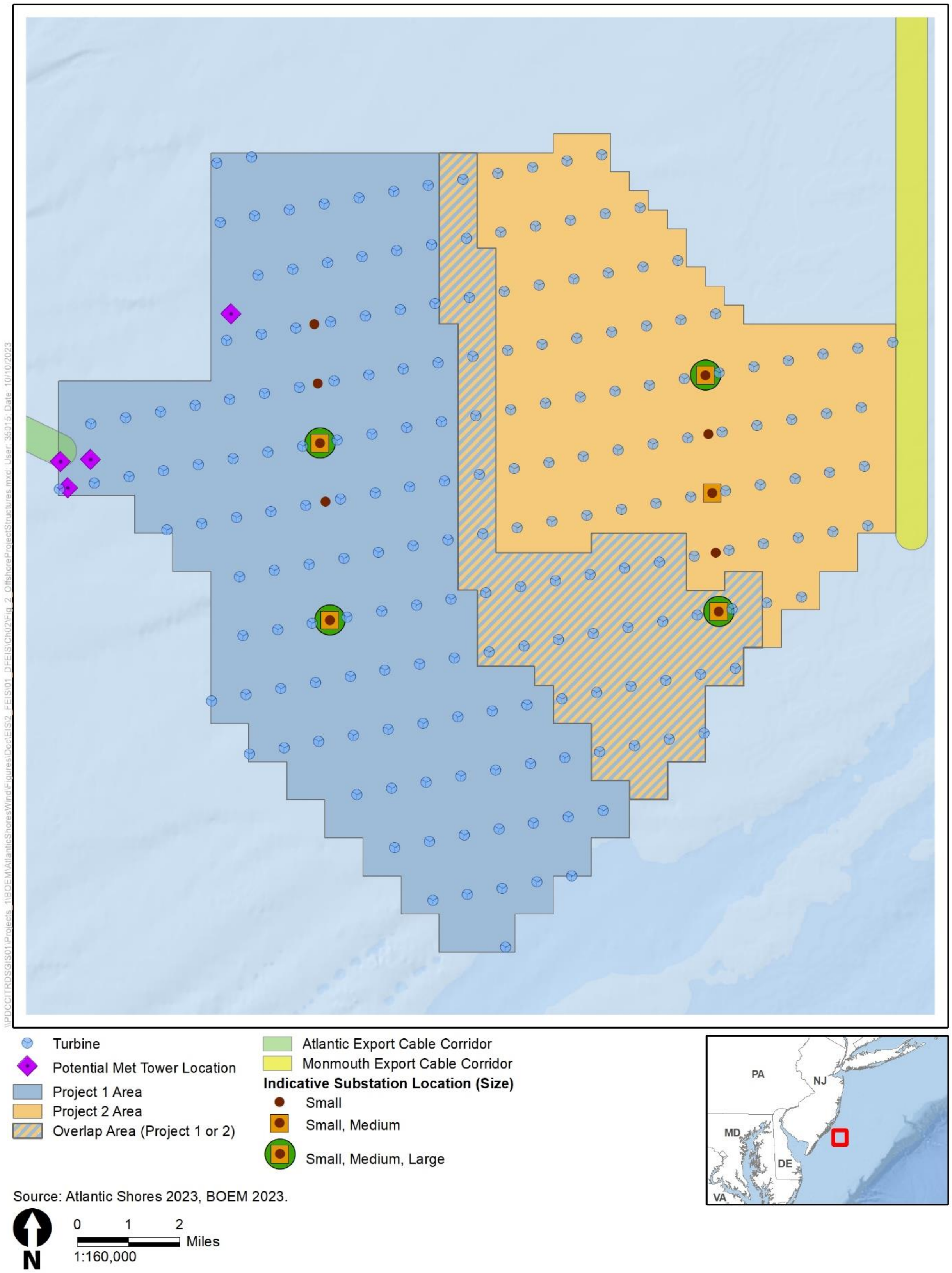


Figure 2.1-6. Offshore Project structures

2.1.2.2 Operations and Maintenance

Once installed and commissioned, both Project 1 and Project 2 are designed to operate for up to 30 years.[6] O&M activities would ensure that Project 1 and Project 2 function safely and efficiently. To minimize equipment downtime and maximize energy generation, the Project would conduct O&M activities through scheduled, predictive, and remotely controlled activities. Remotely controlled activities include remotely turning on and off Project equipment to accommodate maintenance activities, requests from grid operators or USCG, or other activities, and continuous remote monitoring of the status, production, and health of offshore structures, cables, and equipment.

The Project's facilities would operate autonomously without onsite attendance by technicians. Project 1 and Project 2 would be equipped with a supervisory control and data acquisition (SCADA) system, which would provide an interface between each Project's facilities and all environmental and condition monitoring sensors and would provide detailed performance and system information. The operator would monitor the status, production, and health of the Project 24 hours a day. As part of the Proposed Action, an O&M facility would be constructed in Atlantic City, New Jersey, on a 1.38-acre (0.56-hectare) vacant site previously used for vessel docking or other port activities (Figure 2.1-7). Construction of the O&M facility would involve construction of a new building and potentially an associated parking structure, repairs to the existing docks, and installation of new dock facilities. The O&M facility may utilize the parking lot on South California Avenue at the Atlantic Landfall Site or other existing surface lots in Atlantic City supported by shuttles to and from the O&M facility. The new O&M facility may include installation of a communication antenna with a height up to 120 feet (36.6 meters). Repair or installation of a new bulkhead and maintenance dredging in coordination with Atlantic City's dredging of the adjacent basins would be conducted regardless of the construction and installation of the Proposed Action. However, the bulkhead and dredging are necessary for the use of the O&M facility included in the Proposed Action. Therefore, the bulkhead repair/installation and dredging activities are considered to be a connected action under NEPA (Section 2.1.2.4). As shown in Figure 2.1-7, the dock repair and installation area overlaps with the area associated with the connected action activities.

Scheduled maintenance would be performed on a fixed, predetermined schedule (e.g., annually) and may consist of remote monitoring, inspections, testing, replacement of consumables, and preventative maintenance. As part of the scheduled maintenance, self-inspections would be conducted in accordance with 30 CFR 285.824 and 285.825. Scheduled maintenance of offshore facilities would be performed during non-winter months when accessibility would be highest. The frequency of inspections, tests, and maintenance would be based on industry standards and best practices.

---

[6] For analysis purposes, BOEM assumes in this Final EIS that the proposed project would have an operating period of 30 years. Atlantic Shores' lease with BOEM (Lease OCS-A 0499) has an operational term of 25 years that commences on the date of COP approval. (See https://www.boem.gov/sites/default/files/documents/oil-gas-energy/OCS-A%200499%20Lease.pdf; see also 30 CFR 585.235(a)(3).) Atlantic Shores would need to request and be granted a renewal of the operations term of its lease under BOEM's regulations at 30 CFR 585.425 et seq. in order to operate the proposed Atlantic Shores South Project for 30 years. While Atlantic Shores has not made such a request, this Final EIS uses the longer period in order to avoid the possibility of underestimating any potential effect.

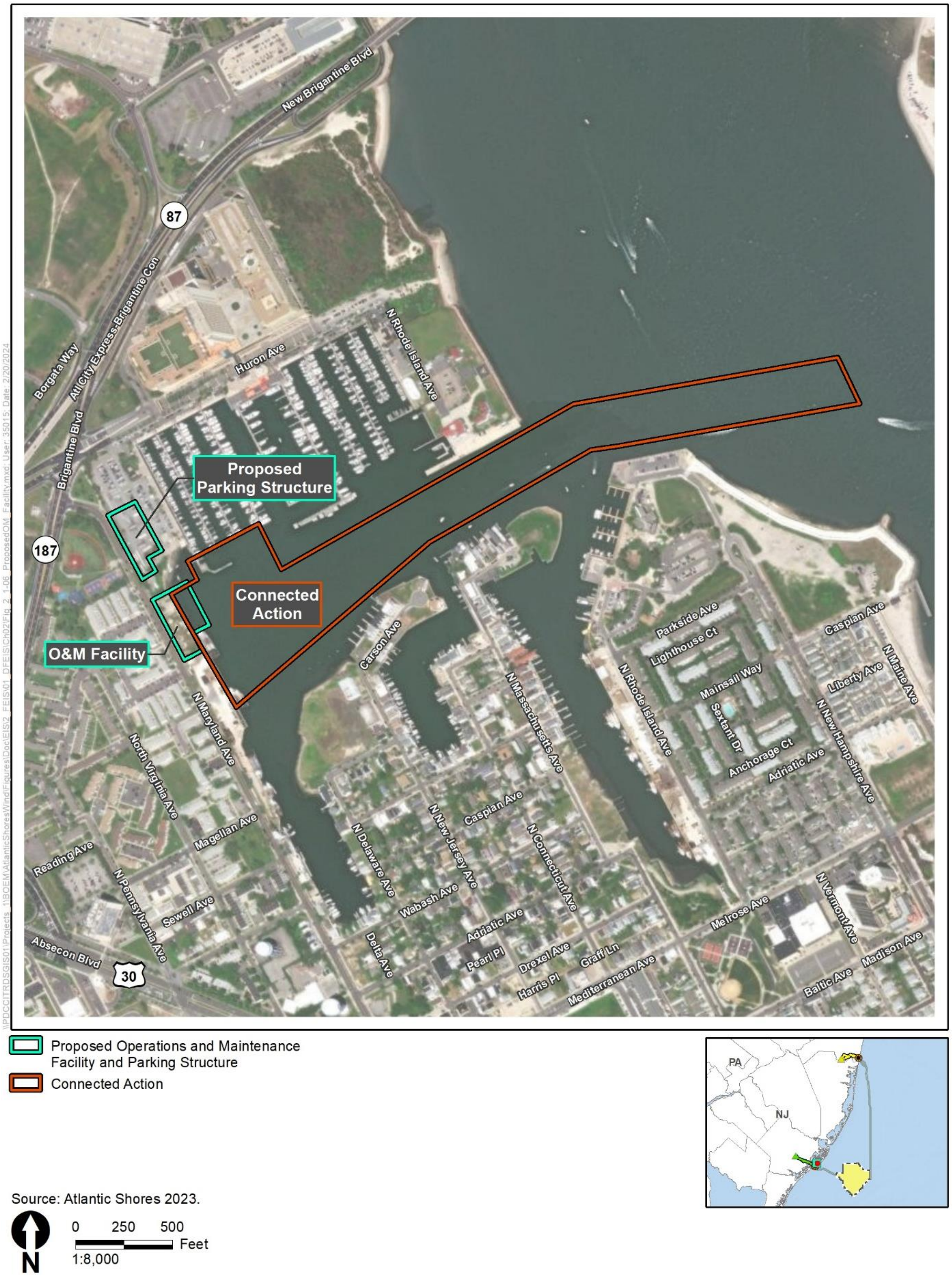


Figure 2.1-7. Proposed operations and maintenance facility

Unscheduled maintenance would be performed in response to a sensor alarm or fault indicating a component malfunction or in response to an event that causes accidental damage. Unscheduled maintenance may involve inspections, troubleshooting, and corrective maintenance, and would occur at any time of the year. Atlantic Shores would conduct a post-event inspection after an event that causes damage to a structure (e.g., a ship allision) or after a storm during which measured environmental conditions exceeded specified conditions (e.g., a hurricane or significant storm event).

Onshore Activities and Facilities

The onshore substations and/or converter stations, onshore export cables, and grid POIs would be inspected regularly and may require preventative maintenance and, as needed, corrective maintenance. Electrical systems at the onshore substations and/or converter stations—such as transformers, switchgear, harmonic filters, reactive power equipment, revenue meters, protection and control systems, and auxiliary services—would be regularly monitored. Scheduled maintenance of the onshore interconnection cables would also be performed; any necessary maintenance would be accessed through manholes and completed within the installed transmission infrastructure.

Offshore Activities and Facilities

Scheduled maintenance of WTGs would include regularly scheduled inspections and routine maintenance of mechanical and electrical components. The types and frequency of inspections and maintenance activities would be based on detailed original equipment manufacturer specifications. Annual maintenance campaigns would be dedicated to general upkeep (e.g., bolt tensioning, crack and coating inspection, safety equipment inspection, cleaning, high-voltage component service, and blade inspection) and replacement of consumable components (e.g., lubrication, oil changes). Best management practices would be employed to reduce the risk of spills, discharges, and accidental releases of lubricants, oils, and fuels during these activities.

OSSs would undergo annual maintenance to both medium-voltage and high-voltage systems, auxiliary systems, and safety systems as well as topside structural inspections. Portions of the topsides may require the reapplication of corrosion-resistant coating. Routine maintenance and refueling would also be performed on diesel generators located on the OSSs.

WTG, OSS, and met tower foundations would be inspected both above and underwater at regular intervals to check their condition, including checking for corrosion, cracking, and marine growth. Scheduled maintenance of foundations would also include safety inspections and testing; coating touch up; preventative maintenance of cranes, electrical equipment, and auxiliary equipment; and removal of marine growth.

The offshore cables would be continuously monitored using a distributed temperature system (DTS), a distributed acoustic sensing (DAS) system, or online partial discharge (OLPD) monitoring. In addition, cable surveys would be performed at regular intervals to identify any issues associated with potential scour and depth of burial. Annual surveys would be performed for the first two to five years of operation. Atlantic Shores would determine inspection intervals based on trends established from inspection and measurement data collected during these annual surveys and updated throughout the life of the Project as new inspections are completed. Additional surveys would be performed, as appropriate, in response to abnormal conditions or significant events, such as major storms, marine incidents in the area, or major maintenance activities. In addition, monitoring systems would be installed on all major components, which would alert Atlantic Shores to potential issues and may trigger additional surveys. Cable terminations and hang-offs would be inspected and maintained during scheduled maintenance of foundations, OSSs, and WTGs. Any unusual observations made during routine maintenance and inspection activities may also trigger additional surveys.

2.1.2.3 Conceptual Decommissioning

Under 30 CFR Part 285 and commercial Renewable Energy Lease OCS-A 0499, Atlantic Shores would be required to remove or decommission all facilities, projects, cables, and pipelines, and clear the seafloor of all obstructions created by the proposed Atlantic Shores South Project (see COP Volume I, Section 6.2; Atlantic Shores 2024). All foundations would need to be removed 15 feet (4.6 meters) below the mudline (30 CFR 285.910(a)). Absent permission from BSEE, Atlantic Shores would have to achieve complete decommissioning within 2 years of termination of the lease and either reuse, recycle, or responsibly dispose of all materials removed. Atlantic Shores has submitted a conceptual decommissioning plan as part of the COP, and the final decommissioning application would outline Atlantic Shores' process for managing waste and recycling proposed Project components (COP Volume I, Section 6.0; Atlantic Shores 2024). Although the proposed Atlantic Shores South Project is anticipated to have an operational life of 30 years, it is possible that some installations and components may remain fit for continued service after this time. Atlantic Shores would need to request and be granted a renewal of the operations term of its lease under BOEM's regulations at 30 CFR 585.425 et seq. if it wanted to operate the proposed Atlantic Shores South Project for more than the 25-year operations term stated in its lease.

BSEE would require Atlantic Shores to submit a decommissioning application upon the earliest of the following dates: 2 years before the expiration of the lease; 90 days after completion of the commercial activities on the commercial lease; or 90 days after cancellation, relinquishment, or other termination of the lease (see 30 CFR 285.905). Upon completion of the technical and environmental reviews, BSEE may approve, approve with conditions, or disapprove the lessee's decommissioning application. This process would include an opportunity for public comment and consultation with municipal, state, and federal management agencies. Atlantic Shores would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed Atlantic Shores South Project. Approval of such activities would require compliance under NEPA and other federal statutes and implementing regulations.

If the COP is approved or approved with modifications, Atlantic Shores would have to submit financial assurance (e.g., a bond) prior to installation that would be held by the U.S. government to cover the cost of decommissioning the entire facility in the event that Atlantic Shores would not be able to decommission the facility, as outlined under 30 CFR Part 585 Subpart E.

Onshore Activities and Facilities

Depending on future environmental assessments and consultations with state and municipal agencies, onshore facilities (e.g., onshore substations and buried duct banks) would either be retired in place or reused for other purposes. For example, because removing buried concrete duct banks would require excavations similar to those involved with installation, leaving these conduits in place for other infrastructure could be less disruptive and beneficial. Even if duct banks are left in place for future use, the onshore cables would likely be removed from the conduits and recycled accordingly.

Offshore Activities and Facilities

Decommissioning of the WTGs and OSSs would be a "reverse installation" process, with turbine components or the OSS topside structure removed prior to foundation removal (scour). The procedures used for decommissioning the WTG and OSS foundations would depend on the type of foundation. Piled foundations would be cut below the mudline and would be completely removed above that cut. Suction bucket foundations would be injected with water essentially reversing the installation process, enabling the complete removal of the foundation. The gravity foundations would have the ballasts within the foundations removed and the foundations would be floated away. If it is not possible to re-float the gravity foundation, it would be disassembled onsite, and all components removed.

Similar to WTGs and OSS topsides, the met tower would be disassembled and removed from its foundation using cranes, shipped to shore, and recycled or scrapped.

Export cables, interarray cables, and interlink cables (if present) would either be retired in place or removed from the seabed. The decision regarding whether to remove these cables and any overlying cable protection would be made based on future environmental assessments and consultations with federal, state, and municipal resource agencies.

2.1.2.4 Connected Action

This Final EIS analyzes the planned bulkhead repair and/or replacement and maintenance dredging activities as a connected action under NEPA per 40 CFR 1501.9(e)(1). The bulkhead site and dredging activities would be conducted within an approximately 20.6-acre (8.3-hectare) site within Atlantic City's Inlet Marina area. Available records indicate that the area was historically dredge-maintained during the 1950s and 1980s (USACE 2022).

The existing bulkhead is an approximately 250-foot (76-meter) structure consisting of multiple sections that are made from steel sheet piles, timbers, and concrete. The bulkhead is missing sections, leading it to become unstable and increasing the potential for erosion. Repair and/or replacement of the existing bulkhead is required in order to stabilize the shoreline and prevent additional erosion and would be necessary regardless of whether the Proposed Action is implemented. Independently of the Proposed Action, Atlantic Shores is pursuing a Nationwide Permit 13 to install an approximately 541-foot (165-meter) bulkhead composed of corrugated steel sheet pile. The new bulkhead will be sited externally of the existing bulkhead, as the existing bulkhead will remain in place, unless removal of specific sections is required to safely install the new bulkhead. It is anticipated that the new bulkhead will be supported by anchor piles. The final design and scope of the anticipated bulkhead replacement work, including dimensions, areas, volumes, construction methodologies, mitigation measures, and other details are subject to change following ongoing design work and permit review and approval. Final details will be included in the approved permit.

The City of Atlantic City obtained a USACE approval (CENAP-OPR-2021-00573-95) and a NJDEP Dredge Permit (No. 0102.20.0001.1 LUP 210001) to perform 10-year maintenance dredging of 13 city waterways, inclusive of the area associated with the proposed O&M facility: Clam Creek and Farley's Marina Fuel. Atlantic City's maintenance dredging program targets substantial shoaling that has built up over the last century and would include dredging 122,710 cubic yards (93,818 cubic meters) of shoaled sediments from a 17.75-acre (7.18-hectare) section of Clam Creek and dredging 20,113 cubic yards (15,378 cubic meters) of shoaled sediments from the 2.86-acre (1.16-hectare) footprint of Farley's Marina Fuel.

The City's maintenance dredging program would reestablish a water depth of 15 feet (4.6 meters) below the plane of Mean Low Water (MLW) plus 1.0 foot (0.3 meter) of allowable overdredge and 4:1 slide slopes within the site. Dredging would be accomplished via hydraulic cutterhead dredge with pipeline or mechanical dredge. The hydraulic cutterhead dredge would be the primary dredge method, with the mechanical dredge utilized to access small marina, canal, or lagoon areas. The hydraulic dredge pipeline will be marked in accordance with USCG regulations and would be sunken, except where submerged aquatic vegetation is encountered, in which case the pipeline would be floated. All resultant dredged material at the site would be removed and disposed of at Dredged hole (DH) #86, a subaqueous borrow pit restoration site, in Beach Thorofare in Atlantic City, New Jersey, and in accordance with Department of the Army Permit Number NAP-2020-00059-95. DH #86 is owned and maintained by New Jersey Department of Transportation, Office of Maritime Resources (NJDOT-OMR). Placement of dredged material into DH #86 is contingent upon execution of a use agreement between Atlantic City and NJDOT-OMR. Each maintenance dredging event included within the permit anticipates a duration of approximately 12 weeks, including mobilization and demobilization, dredging, and material placement activities.

The maintenance dredging activities would serve to maintain safe navigational depths for transiting vessels by re-establishing in-water depths consistent with depths historically maintained in collaboration with dredging activities of adjacent harbors and waterways. These activities would be implemented independently from the Proposed Action.

2.1.3 Alternative C – Habitat Impact Minimization/Fisheries Habitat Impact Minimization

Alternative C was developed through the scoping process for the EIS in response to comments received from the Mid-Atlantic Fishery Management Council (MAFMC), New England Fishery Management Council (NEFMC), NMFS, and the Environmental Protection Agency (USEPA). Alternative C includes four sub-alternatives, which would avoid entirely, or in part, two AOCs identified by NMFS within the Lease Area that have pronounced bottom features and produce valuable habitat. AOC 1 is part of a designated recreational fishing area called “Lobster Hole,” and AOC 2 is part of a sand ridge (ridge and swale) complex. The layout and number of WTGs and OSSs would be adjusted to avoid and minimize potential impacts on these identified habitats.

Generally, sand ridge and trough features are physical features that are found throughout the OCS in the mid-Atlantic and provide habitat for various species. Ridge and swale habitat provide complex physical structures that affect the composition and dynamics of ecological communities, with increased structural complexity often leading to greater species diversity, abundance, overall function, and productivity. In the mid-Atlantic sand ridges and troughs are areas of biological significance for migration and spawning of mid-Atlantic fish species, many of which are recreationally targeted in those specific areas. A more detailed analysis by resource can be found in Section 3.5, *Biological Resources*. Although the overall artificial reef effect would be decreased by reducing the total number of WTGs in the Lease Area, the biological benefits of preserving natural fish habitat may be beneficial. Each of the sub-alternatives may be individually selected or combined with any or all other alternatives, subject to the combination meeting the purpose and need.

2.1.3.1 Alternative C1 – Lobster Hole Avoidance

Alternative C1 would avoid and minimize the potential impacts on the Lobster Hole (AOC 1), a designated recreational fishing area, by removing up to 16 WTGs, 1 OSS, and associated interarray cables, as shown on Figure 2.1-8.

2.1.3.2 Alternative C2 – Sand Ridge Complex Avoidance

Alternative C2 would avoid and minimize potential impacts on the sand ridge features in the southern-most portion of the Lease Area (AOC 2) by removing up to 13 WTGs and associated interarray cables within the NMFS-identified sand ridge complex (Figure 2.1-9).

2.1.3.3 Alternative C3 – Demarcated Sand Ridge Complex Avoidance

Alternative C3 would remove up to 6 WTGs and associated interarray cables within 1,000 feet (305 meters) of the sand ridge complex area identified by NMFS, but further demarcated using NOAA’s Benthic Terrain Modeler and bathymetry data provided by Atlantic Shores (Figure 2.1-10).

2.1.3.4 Alternative C4 – Micrositing

Alternative C4 was proposed by Atlantic Shores and would involve the micrositing of 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within both AOC 1 and AOC 2. Micrositing would be undertaken to reduce impacts on complex habitat but would not materially change the grid layout[7] (e.g., generally within 500 feet [152 meters] of

---

[7] Micrositing would not materially change the grid layout. No microsited permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern.

foundation locations) that is necessary to preserve safe navigation conditions and USCG Search and Rescue (SAR) missions.

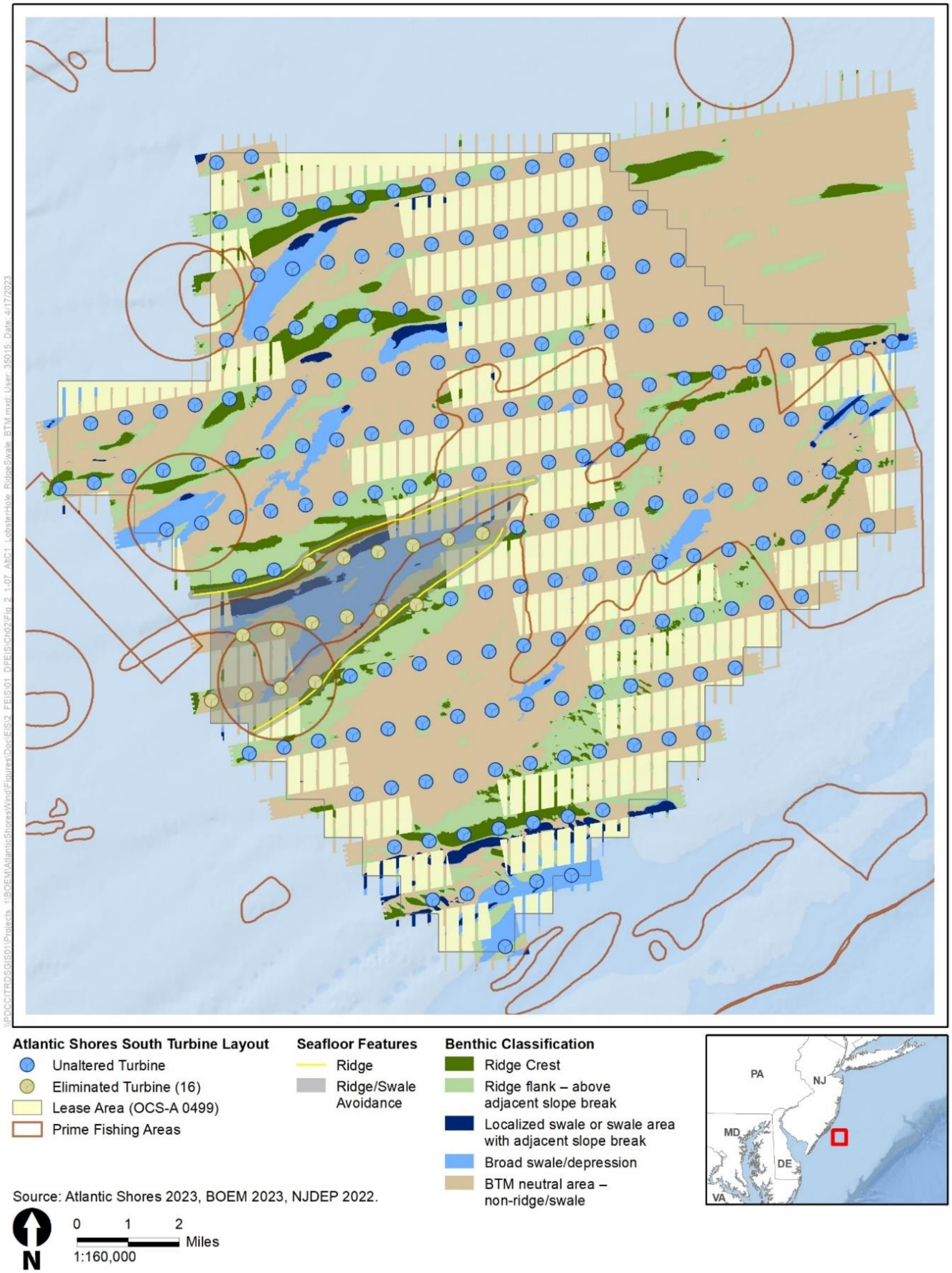


Figure 2.1-8. Alternative C1 – Lobster Hole Avoidance

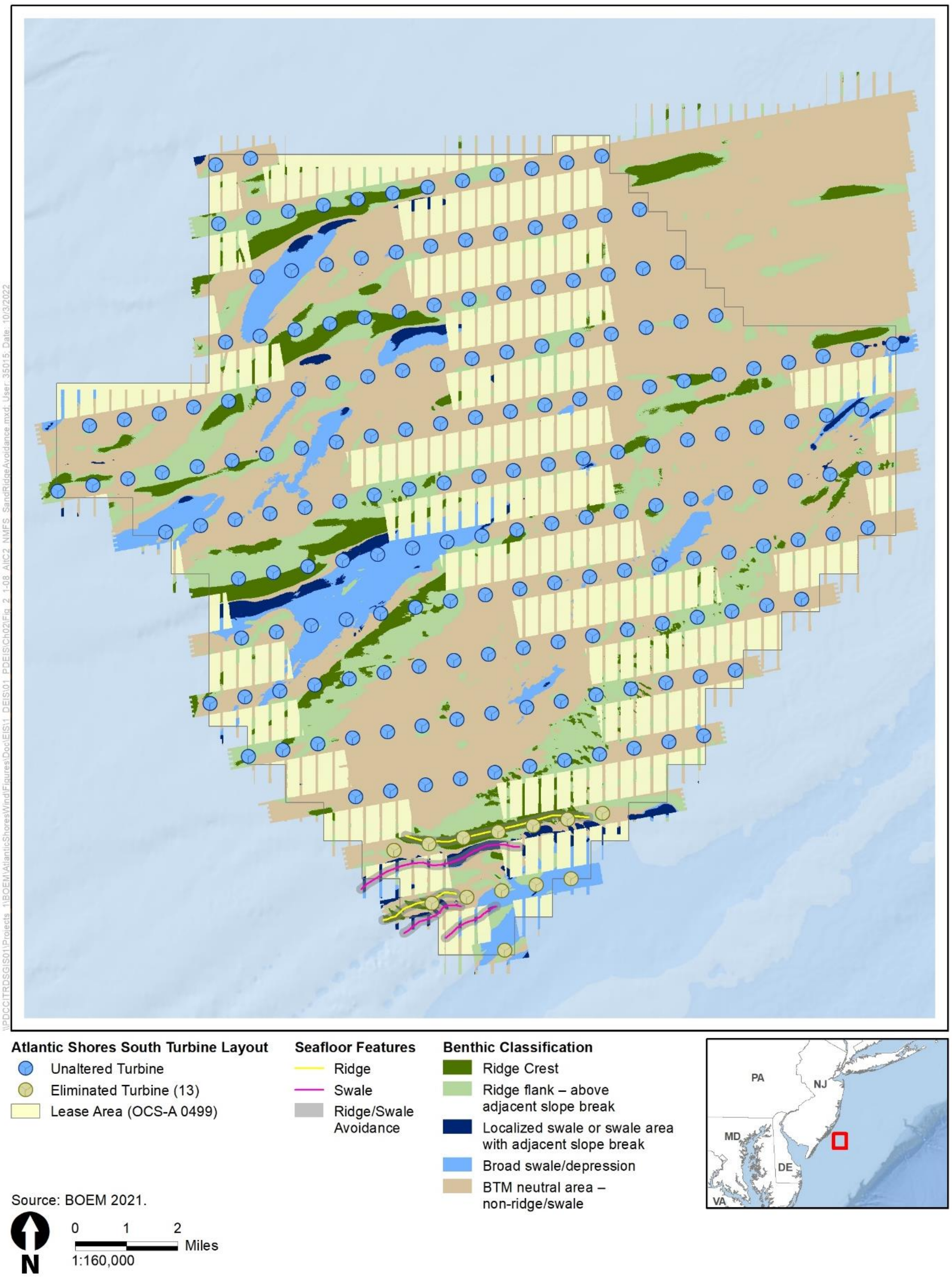


Figure 2.1-9. Alternative C2 –Sand Ridge Complex Avoidance

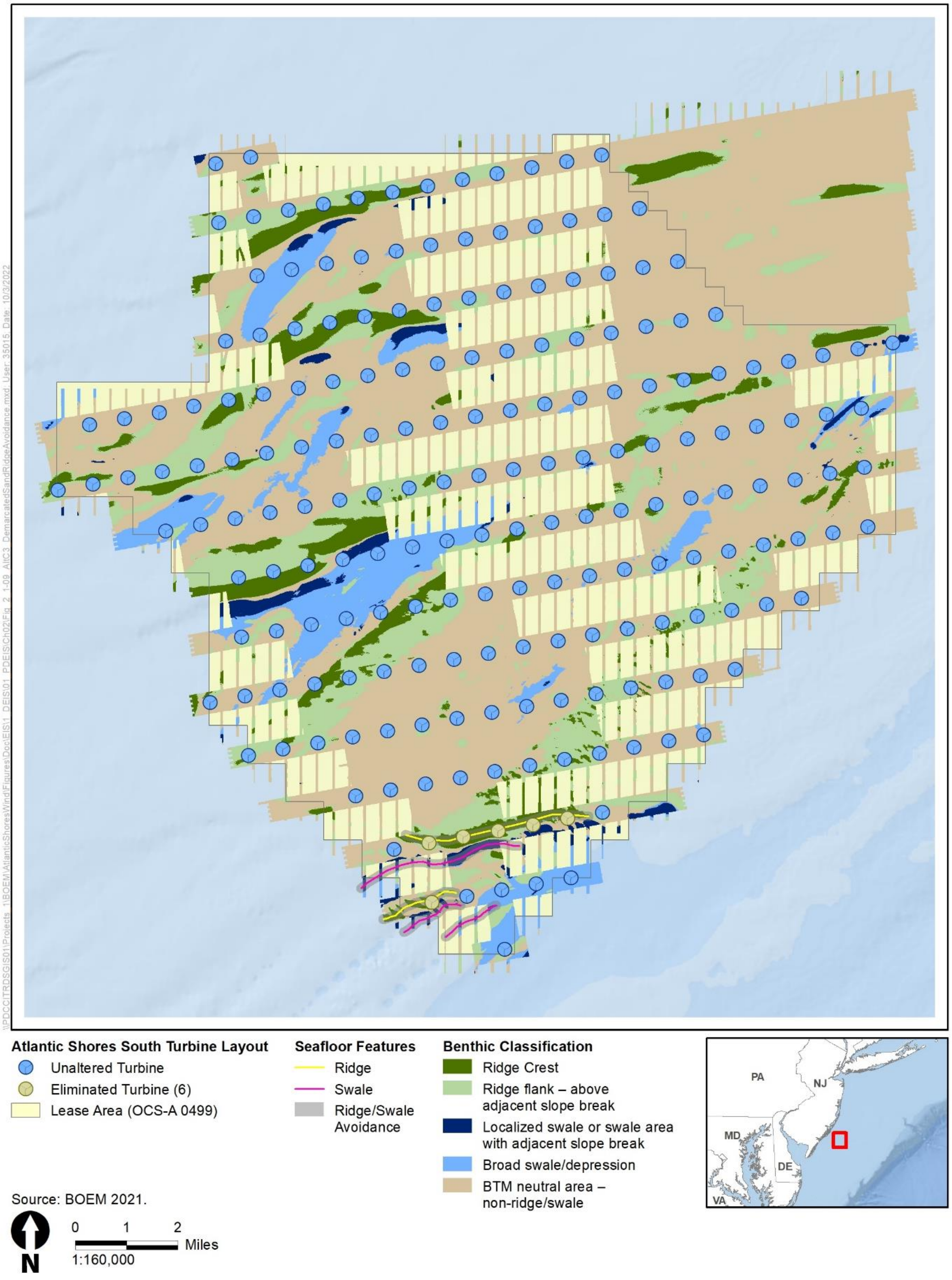


Figure 2.1-10. Alternative C3 – Demarcated Sand Ridge Complex Avoidance

2.1.4 Alternative D – No Surface Occupancy at Select Locations to Reduce Visual Impacts

Alternative D was developed through the scoping process for the EIS in response to public comments concerning the visual impacts of the Atlantic Shores South Project. Under Alternative D, no surface occupancy would occur within defined distances to shore to reduce the visual impacts of the proposed Project. The remaining range of design parameters for Project components and activities to be undertaken for construction and installation, O&M, and conceptual decommissioning would be the same as described in the Proposed Action. Alternative D includes three sub-alternatives where the number of WTGs and turbine heights would be adjusted to reduce visual impacts. Each of the sub-alternatives may be individually selected or combined with any or all other alternatives, subject to the combination meeting the purpose and need.

2.1.4.1 Alternative D1 – No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines

Alternative D1 would result in the exclusion of up to 21 WTG positions in Project 1 within 12 miles (19.3 kilometers) from shore (Figure 2.1-11). The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL. The overall exclusion of WTG positions would result in a reduced annual energy production and BOEM is continuing to assess the energy production impact and feasibility of this alternative. The final number of WTG positions considered for exclusion in the Final EIS may be reduced to fewer than 21 to ensure consistency with the 1,510-MW nameplate capacity and annual allowance awarded to Atlantic Shores by BPU, and any additional offtake agreements that are finalized prior to the Final EIS.

2.1.4.2 Alternative D2 – No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines

Alternative D2 would result in the exclusion of up to 31 WTG positions in Project 1 that are sited closest to shore (Figure 2.1-12). The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL. The overall exclusion of WTG positions would result in reduced annual energy production and BOEM is continuing to assess the energy production impact and feasibility of this alternative. The final number of WTG positions considered for exclusion in the Final EIS may be reduced to fewer than 31 to ensure consistency with the 1,510-MW nameplate capacity and annual allowance awarded to Atlantic Shores by BPU, and any additional offtake agreements that are finalized prior to the Final EIS.

2.1.4.3 Alternative D3 – No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines

Alternative D3 would result in the exclusion of up to 6 WTG positions in Project 1 that are sited closest to shore (Figure 2.1-13). The remaining turbines in Project 1 would be restricted to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL.

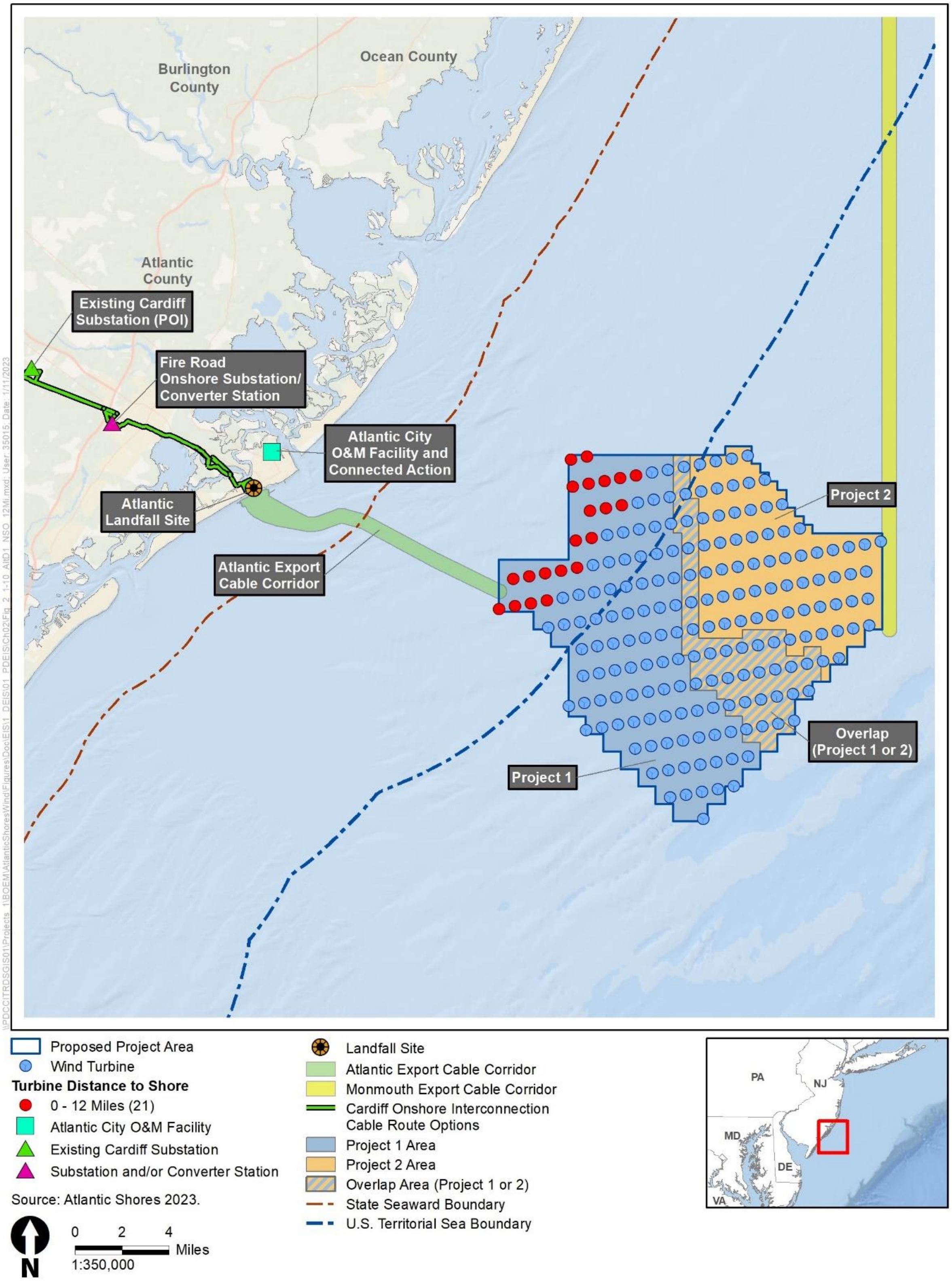


Figure 2.1-11. Alternative D1 – No Surface Occupancy of Up to 12 Miles (19.3 Kilometers) from Shore: Removal of Up to 21 Turbines

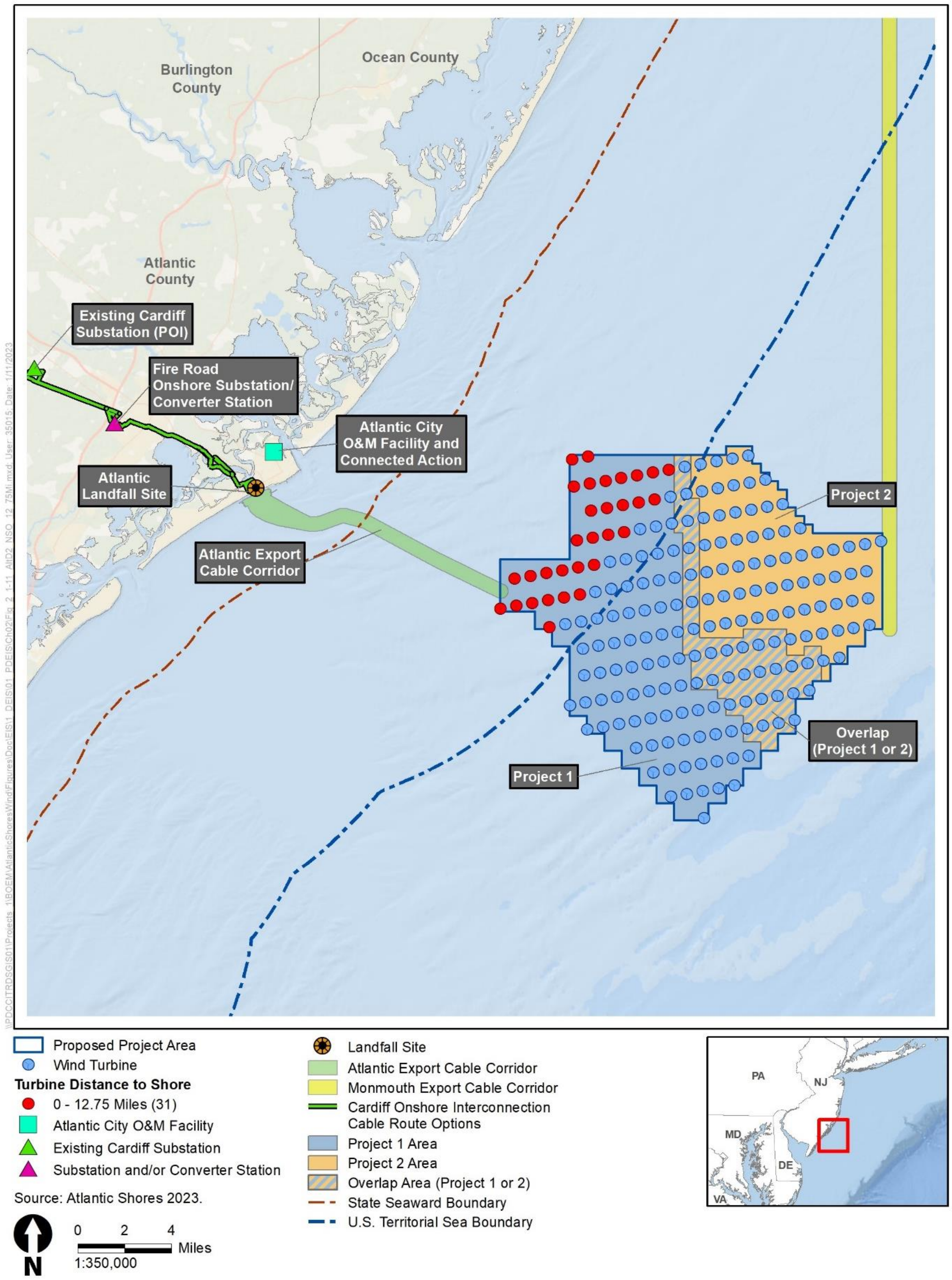


Figure 2.1-12. Alternative D2 – No Surface Occupancy of Up to 12.75 Miles (20.5 Kilometers) from Shore: Removal of Up to 31 Turbines

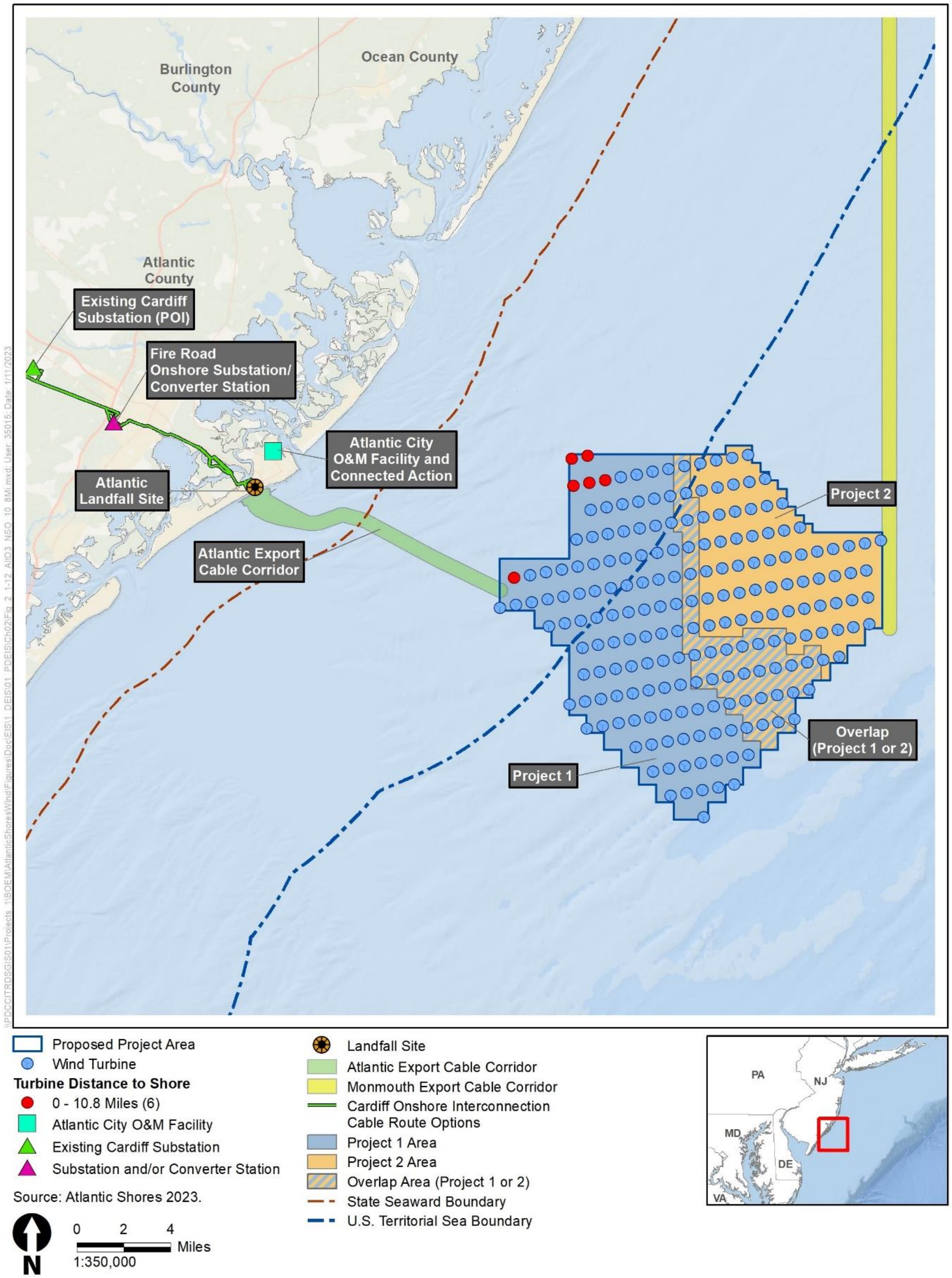


Figure 2.1-13. Alternative D3 – No Surface Occupancy of Up to 10.8 Miles (17.4 Kilometers) from Shore: Removal of Up to 6 Turbines

2.1.5 Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1

Alternative E was developed through the scoping process for the EIS in response to comments received from the Responsible Offshore Development Alliance (RODA) concerning the different layouts between the Atlantic Shores South and Ocean Wind 1 projects and the need for a setback between the adjacent areas. Modifications would be made to the wind turbine array layout to create a 0.81-nautical- mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) and the WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation (Figure 2.1-14).

This alternative would result in no surface occupancy along the southern boundary of the Atlantic Shores South Lease Area through the exclusion or micrositing of up to 4 to 5 WTG positions. Ocean Wind 1 is currently proposing a layout[8] with a goal of creating a total buffer distance of 0.81 nautical mile (1,500 meters) between WTGs in both projects; however, Ocean Wind 1 would need to modify its wind turbine layout in order to create a total buffer distance greater than 0.81 nautical mile (1,500 meters). This Final EIS only analyzes the portion of the setback within the Atlantic Shores South Lease Area. A setback would provide a clear visual distinction between the separate projects and provide for sufficient maneuvering space for both surface and aerial (helicopter) navigation.

The range of design parameters for Project components and activities to be undertaken for construction and installation, O&M, and conceptual decommissioning would be the same as described for the Proposed Action.

[8] Ocean Wind, LLC and Atlantic Shores Offshore Wind, LLC in coordination with USCG, developed a mutually agreeable scenario for the Ocean Wind 1 and Atlantic Shores South Projects, which was documented in a joint letter signed by both developers on July 21, 2022. This scenario is covered in the setback range identified in Alternative E.

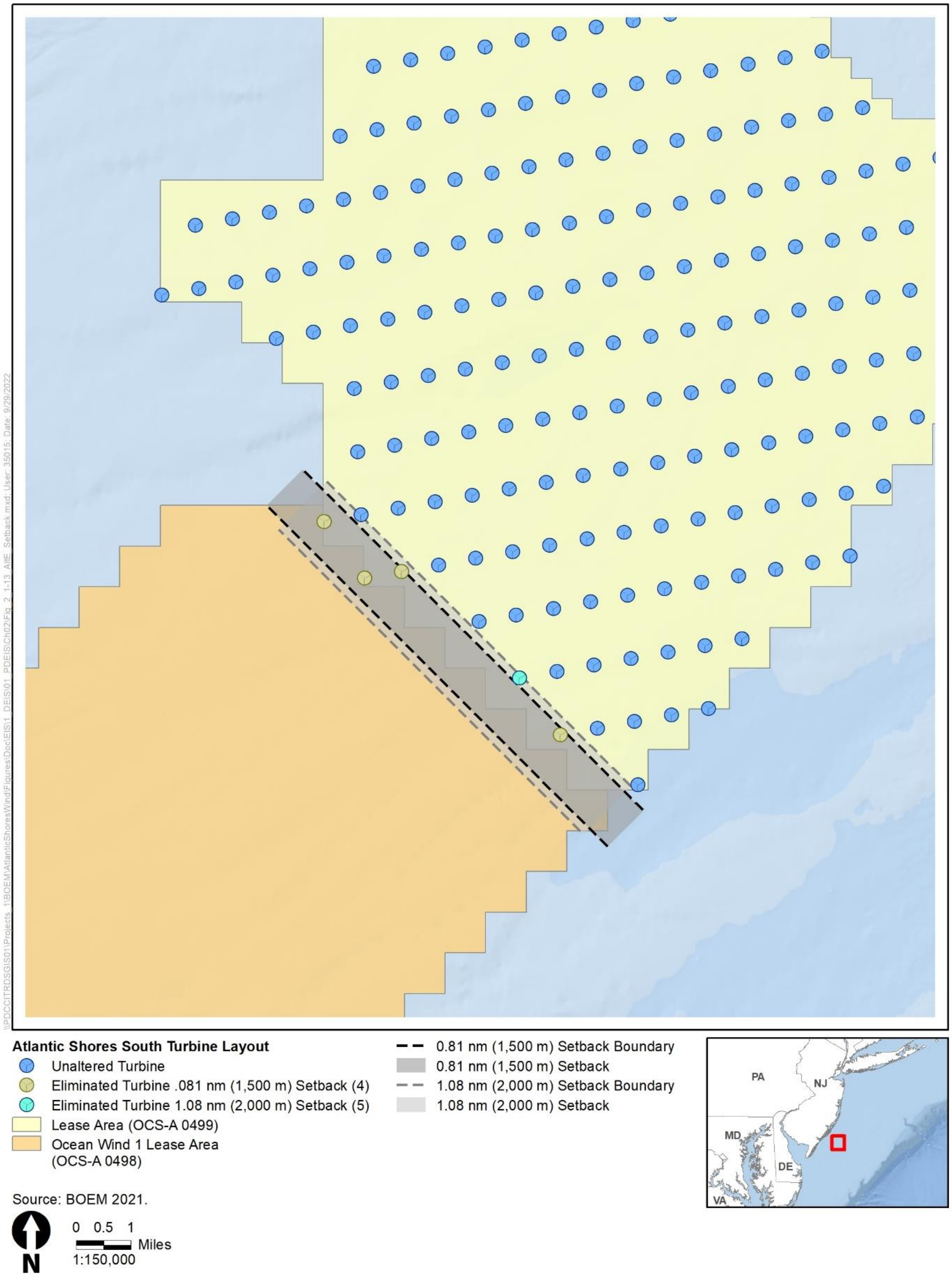


Figure 2.1-14. Alternative E – Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1

2.1.6 Alternative F – Foundation Structures

Alternative F was developed through the scoping process for the EIS in response to comments, as well as options posed in the COP. Alternative F addresses the possibility for one or more foundation types to be utilized for WTGs, OSSs, and the permanent met tower, and includes three sub-alternatives that detail the different foundation structures. Depending on the final OSS design, there would be up to five small OSSs, two medium OSSs, or two large OSSs for Project 1; and up to five small OSSs, three medium OSSs, or two large OSSs for Project 2. The type of OSS foundation used depends on the size of the OSS itself as shown in Table 2-4. For the small OSS, the PDE for each foundation type is identical to the PDE for the WTG foundations. The total foundation footprint, temporary seabed impacts, and combined impacts are all higher for the large OSSs; however, the total temporary seabed disturbance area is slightly higher for the small OSSs. The foundation options for the met tower include all options under consideration for WTG foundations, and the construction methodologies for the met tower are assumed to be the same as those for the WTG foundations. Different foundation types could be used for Project 1 and Project 2 and for different components within each project. The foundation type selected for the WTGs may be different from the foundation type selected for OSSs.

Table 2-4. OSS foundation types

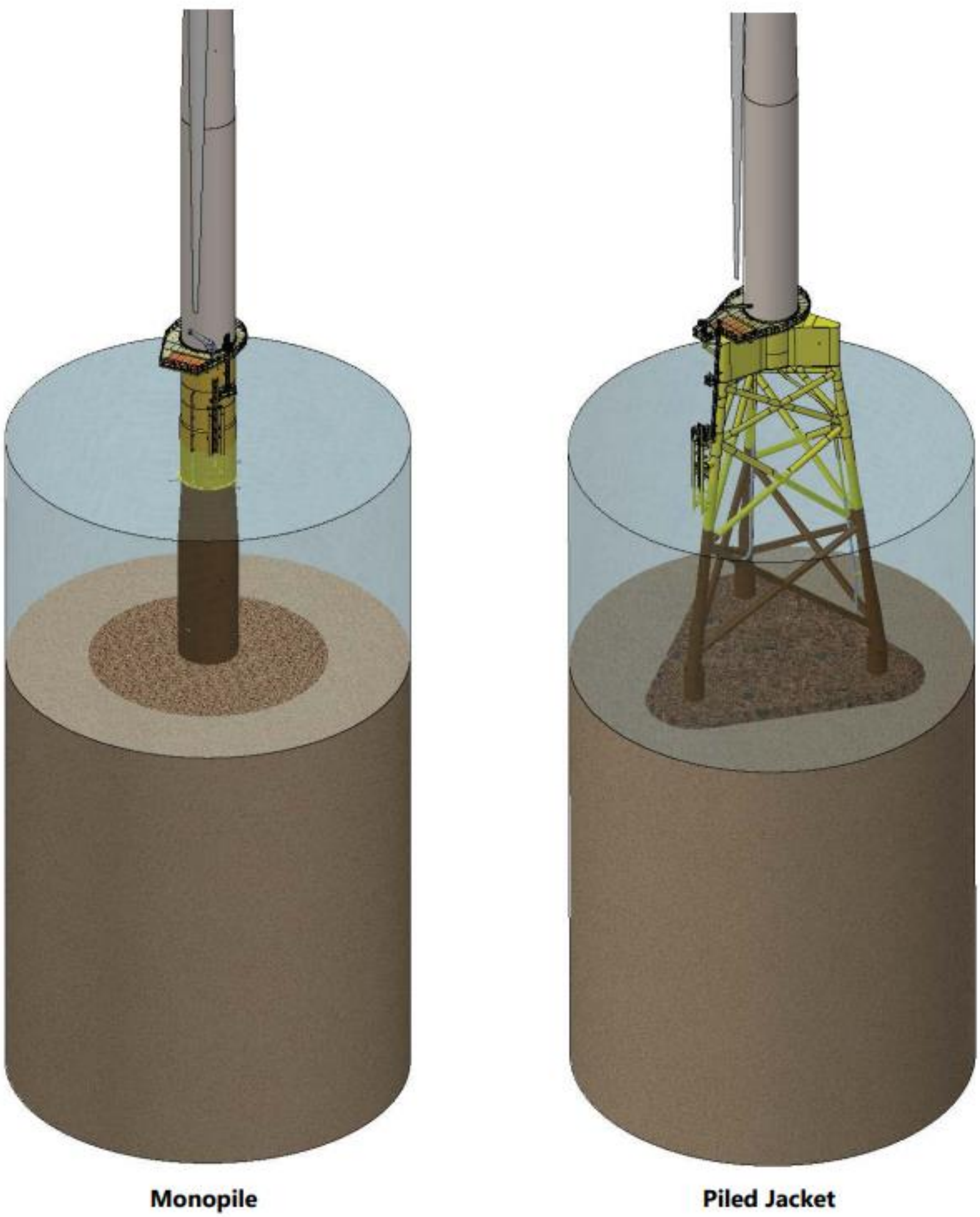
Foundation Types		Small OSS	Medium OSS	Large OSS
Piled	Monopile	•		
	Piled Jacket	•	•	•
Suction Bucket	Mono-Bucket	•		
	Suction Bucket Jacket	•	•	•
Gravity	GBS	•	•	•

Source: COP Volume I, Table 4.4-1; Atlantic Shores 2024.

This Final EIS analyzes the maximum potential impacts on each environmental resource from each type of foundation: piled, suction bucket, and gravity-based at a project level. A representation of the impacts that could occur given the choice of foundation type per project can be found in Table 2-5. The table looks at the maximum extent of how each foundation type used within Project 1, and separately Project 2, could affect a resource. Once combined, the combined configuration of foundations for Project 1 and Project 2 would not exceed 211 (200 turbines, 10 OSSs, and 1 met tower).

2.1.6.1 Alternative F1 – Piled Foundations

Under Alternative F1, the use of the monopile and piled jacket foundation structures (Figure 2.1-15) for up to 200 WTGs, 1 permanent met tower (Project 1), and either up to 10 small OSSs (monopile or piled jacket), up to 5 medium OSSs (piled jacket), or 4 large OSSs (piled jacket) for Project 1 and Project 2 would be analyzed for the extent of impacts.

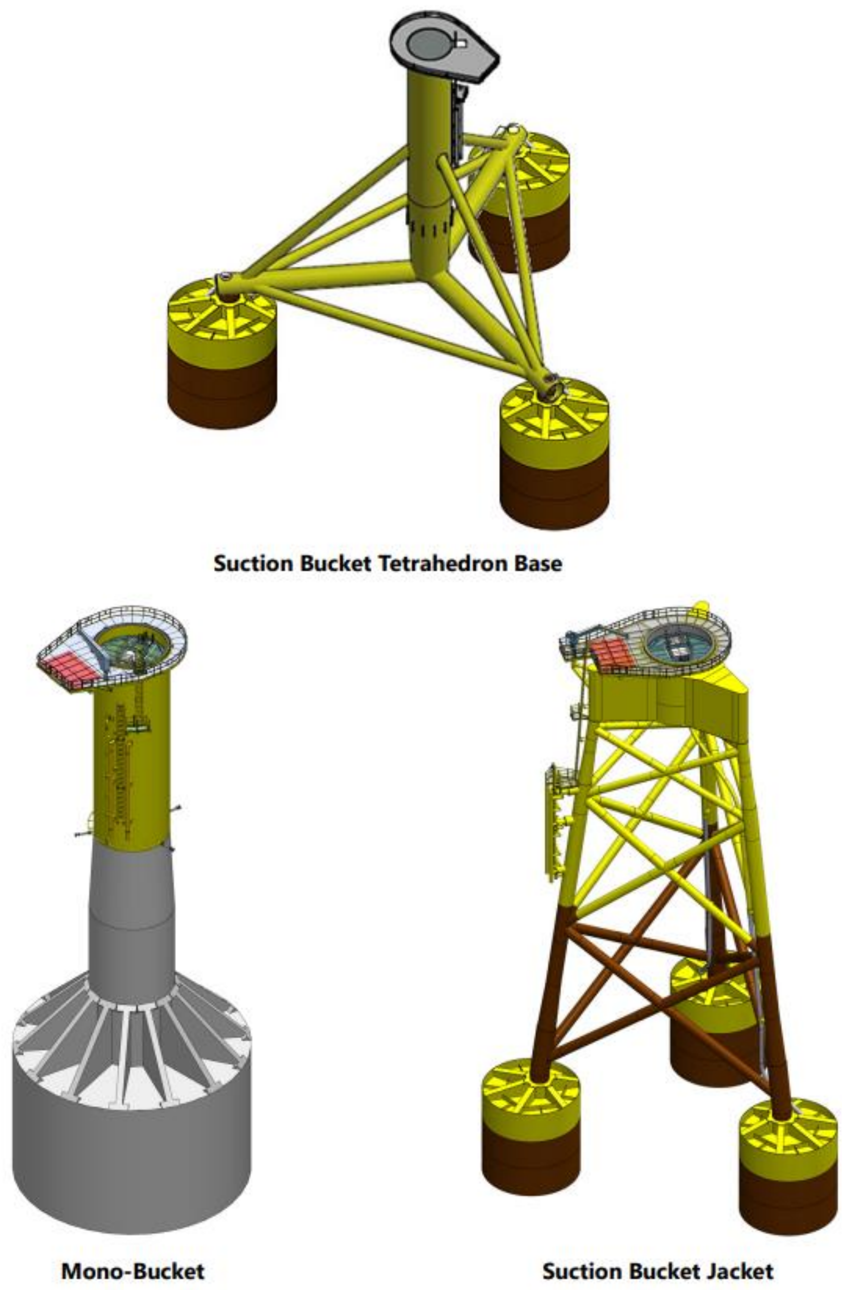


Source: Atlantic Shores 2024.

Figure 2.1-15. Piled foundations

2.1.6.2 Alternative F2 – Suction Bucket Foundations

Under Alternative F2, the use of mono-bucket, suction bucket jacket, and suction bucket tetrahedron base foundations (Figure 2.1-16) for up to 200 WTGs, 1 permanent met tower (Project 1), and up to 10 small OSSs (mono-bucket or suction bucket jacket), up to 5 medium OSSs (suction bucket jacket), or up to 4 large OSSs (suction bucket jacket), for Project 1 and Project 2 would be analyzed for the extent of impacts.

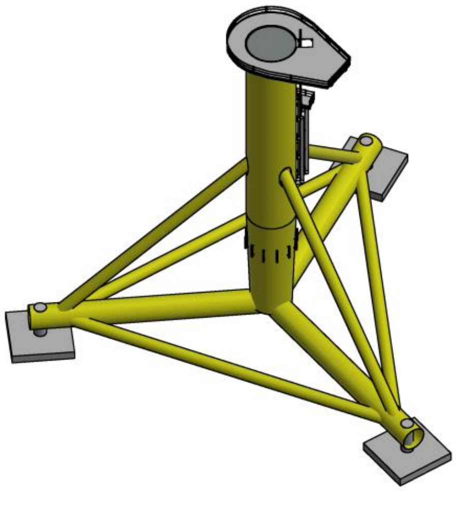


Source: Atlantic Shores 2024.

Figure 2.1-16. Suction bucket foundations

2.1.6.3 Alternative F3 – Gravity-Based Foundations

Under Alternative F3, the use of gravity-pad tetrahedron and GBS foundations (Figure 2.1-17) for up to 200 WTGs, 1 permanent met tower (Project 1), and up to 10 small OSSs, up to 5 medium OSSs, or up to 4 large OSSs for Project 1 and Project 2 would be analyzed for the extent of impacts.



Source: Atlantic Shores 2024.

Figure 2.1-17. Gravity foundations

Table 2-5. Resource effects by foundation type

Resource Affected	Foundation Types: Monopile and Piled Jacket — Project 1 (Maximum 136 Turbines, 1 Permanent Met Tower,[1] and 2 Large OSSs)	Monopile and Piled Jacket — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)
Habitat Loss: • Species displacement or mortality • Soft-bottom habitat loss	In general, foundations would be positioned or sized to avoid or reduce seabed preparation where possible. This will include the area of habitat conversion due to the number of foundations and scour protection. Maximum area of seabed preparation per WTG foundation[2] is 72,377 square feet. Maximum permanent footprint area per foundation (foundation + scour protection + mud mats [post-piled jackets only]) for the piled jacket, large OSS is 136,954 square feet.	Similar to Project 1 but reduced given the lower number of foundations and area of scour protection. Maximum area of seabed preparation per foundation[2] is 72,377 square feet. Maximum permanent footprint area per foundation (foundation + scour protection + mud mats [post-piled jackets only]) for the piled jacket, large OSS is 136,954 square feet.	Greatest area of habitat conversion due to scour protection. Maximum area of seabed preparation per foundation[2] is 111,988 square feet. Maximum permanent footprint area per foundation for the suction bucket jacket, large OSS is 282,961 square feet.	Greatest area of habitat conversion due to scour protection. Maximum area of seabed preparation per foundation[2] is 111,988 square feet. Maximum permanent footprint area per foundation for the suction bucket jacket, large OSS is 282,961 square feet.	Soft bottoms may be removed during seabed preparation. Maximum area of seabed preparation per foundation is 81,133 square feet. Maximum permanent footprint area per foundation for the GBS, large OSS is 241,111 square feet.	Soft bottoms may be removed during seabed preparation. Maximum area of seabed preparation per foundation is 81,133 square feet. Maximum permanent footprint area per foundation for the GBS, large OSS is 241,111 square feet.
Artificial Reefs and Attraction: • Introduction of organisms that grow on the surfaces of foundations • Increased food source and increased source of prey • Refuge/resting areas for sheltering from currents or predation • Increased predation rates due to higher predator abundance	Increased aggregation of fish near structures; more opportunities around piled jackets than monopiles. The amount of scour protection present may also increase aggregation. Each piled jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each piled jacket large OSS will have a maximum of 8 legs (up to 3 pin piles per leg)/ discrete contact points with the seabed.	Similar to Project 1 but reduced given the lower number of foundations. Each piled jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each piled jacket large OSS will have a maximum of 8 legs (up to 3 pin piles per leg)/discrete contact points with the seabed.	Similar to the piled jacket, the suction bucket tetrahedron base and jacket provide an increased area for aggregation. Each suction bucket jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each suction bucket jacket large OSS will have a maximum of 8 legs/discrete contact points with the seabed.	Similar to Project 1 but reduced given the lower number of foundations. Each suction bucket jacket WTG foundation will have a maximum of 4 legs/discrete contact points with the seabed. Each suction bucket jacket large OSS will have a maximum of 8 legs/discrete contact points with the seabed.	Similar to the piled jacket, the gravity-pad tetrahedron would have an increased opportunity for aggregation. Each gravity-based WTG foundation will have a maximum of 3 legs/discrete contact points. Each large OSS will have a maximum of 2 legs/discrete contact points with the seabed.	Similar to Project 1 but reduced given the lower number of foundations. Each gravity-based WTG foundation will have a maximum of 3 legs/discrete contact points. Each large OSS will have a maximum of 2 legs/discrete contact points with the seabed.
Invasive Species Spread Effects • Introduction of invasive species	Impacts may be widespread and permanent where the species are able to establish populations. Colonization would be limited to the surface area of the foundations and scour protection.	Impacts would be similar to Project 1 but reduced given the lower number of foundations and area of scour protection.	Similar risk to the monopile and piled jacket but with increased surface area associated with the associated foundation legs and area of scour protection.	Impacts would be similar to Project 1 but reduced given the lower number of foundations and area of scour protection.	Larger risk given the increased surface area of the foundations and sour protection.	Impacts would be similar to Project 1 but reduced given the lower number of foundations and area of scour protection.
Wake and Scour: • Increased concentration or availability of prey in wakes • Altered conditions can affect recruitment of larvae of benthic species, suspended sediment concentration, availability of food, oxygen, and waste removal	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 56,844 square feet. The additional volume of scour protection for each large OSS is estimated to be about 666,999 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 56,844 square feet. The additional volume of scour protection for each large OSS is estimated to be about 666,999 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 111,988 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,485,370 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 111,988 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,485,370 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 58,239 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,186,572 cubic feet.	Maximum total permanent footprint per foundation (foundation + scour protection + mud mats [post-piled jackets only]) is 58,239 square feet. The additional volume of scour protection for each large OSS is estimated to be about 1,186,572 cubic feet.

Resource Affected	Foundation Types: Monopile and Piled Jacket — Project 1 (Maximum 136 Turbines, 1 Permanent Met Tower,[1] and 2 Large OSSs)	Monopile and Piled Jacket — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Mono-Buckets, Suction Bucket Jackets, and Suction Bucket Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 1 (Maximum 136 Turbines and 1 Permanent Met Tower, and 2 Large OSSs)	Gravity-Based Structures and Gravity-Pad Tetrahedron — Project 2 (Maximum 95 Turbines and 2 Large OSSs)
Release of Suspended Sediment and Sediment Deposition: • Decreased water quality due to increased suspended sediment • Smothering of species and habitats by deposited sediment • Avoidance of area by species due to increase sediments • Changes in organic matter content in sediments associated with sediment particle size • Exposure to toxic contaminants within sediment	Not expected to require seabed preparation unless the seabed is not sufficiently level. Maximum area of seabed preparation per WTG and met tower foundation is 72,377 square feet.	Not expected to require seabed preparation unless the seabed is not sufficiently level. Maximum area of seabed preparation per WTG foundation is 72,377 square feet.	The majority of suction bucket foundations are not expected to require seabed preparation unless the seabed it is not sufficiently level. Maximum area of seabed preparation per WTG and met tower foundation is 111,988 square feet.	The majority of suction bucket foundations are not expected to require seabed preparation unless the seabed it is not sufficiently level. Maximum area of seabed preparation per WTG foundation is 111,988 square feet.	3–4 days to prepare the seabed through sediment removal. Maximum area of seabed preparation per WTG and met tower foundation is 81,133 square feet.	3–4 days to prepare the seabed through sediment removal. Maximum area of seabed preparation per WTG foundation is 81,133 square feet.
Avoidance Effects: • Displacement of species from the WTA • Disruption of migration routes	During installation, there may be temporary displacement of species in the area. There is an estimated total of 201 piling days for WTGS. See *Acoustic* for installation timeframes.	Similar to Project 1 but with a lower number of required piles.	Similar to the monopile and piled jacket, but the temporary displacement may be more related to the scour protection installation.	Similar to Project 1 but with a lower number of required foundations and scour protection.	Similar to the monopile and piled jacket, but the temporary displacement may be more related to the scour protection installation.	Similar to Project 1 but with a lower number of required foundations and scour protection.
Acoustic: • Mortality or physical injury from noise • Behavioral alterations like startling, fleeing, or hiding • Masking of biologically significant sounds	During the installation, activities that create noise and vibrations may harm or displace marine animals, birds, benthic invertebrates, and finfish. Impact pile driving will last from approximately 3–4 hours per day (piled jacket) to 7–9 hours a day (monopile) with a maximum of two (monopile) to four (piled jacket) installed in a day given the number of piles. The estimated maximum duration to drive one pile for the OSSs is 3–4 hours per day with a maximum of 4 piles driven per day. Other potential anthropogenic sound sources were not quantitatively modeled as they are expected to be much less than impulsive pile driving.	Similar to Project 1 but with a lower number of required piles.	Suction bucket foundation installation is nearly noise free, and the non-impulsive pile installation method is expected to result in low peak pressure noise unlikely to induce injury in fish or pelagic invertebrates. The foundation has the potential to be completely removed upon decommissioning.	Suction bucket foundation installation is nearly noise free, and the non-impulsive pile installation method is expected to result in low peak pressure noise unlikely to induce injury in fish or pelagic invertebrates. The foundation has the potential to be completely removed upon decommissioning.	Other sounds related to the construction, O&M, and decommissioning of the Project are expected to be much less than impulsive pile driving.	Other sounds related to the construction, O&M, and decommissioning of the Project are expected to be much less than impulsive pile driving.

[1] The foundation options for the met tower include all options under consideration for WTG foundations, and the construction methodologies are assumed to be the same as those for WTG foundations.
[2] In a limited number of foundation positions, up to 19.7 feet (6 meters) of seabed leveling could be required. Piled and suction bucket foundations are not expected to require seabed preparation unless the seabed is not sufficiently level.

2.1.7 Preferred Alternative

The CEQ NEPA regulations require the identification of a preferred alternative in the Final EIS. BOEM has identified Alternative B (Proposed Action), in combination with the following, as its Preferred Alternative:

- BOEM-Proposed Mitigation Measure #5 (Appendix G, Table G-3): No permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers)[9] by 1.0 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern. The Project's proposed OSSs, meteorological tower, and WTGs would be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart.
- NOAA/NMFS-Proposed Mitigation Measure #1 (Appendix G, Table G-3): Removal of a single turbine approximately 150 to 200 feet (45.8 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site).
- Alternative C4 (Habitat Impact Minimization/Fisheries Habitat Impact Minimization: Micrositing),
- Alternative D3 (No Surface Occupancy of Up to 10.8 Miles [17.4 Kilometers] from Shore: Removal of Up to 6 Turbines), and
- Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1).

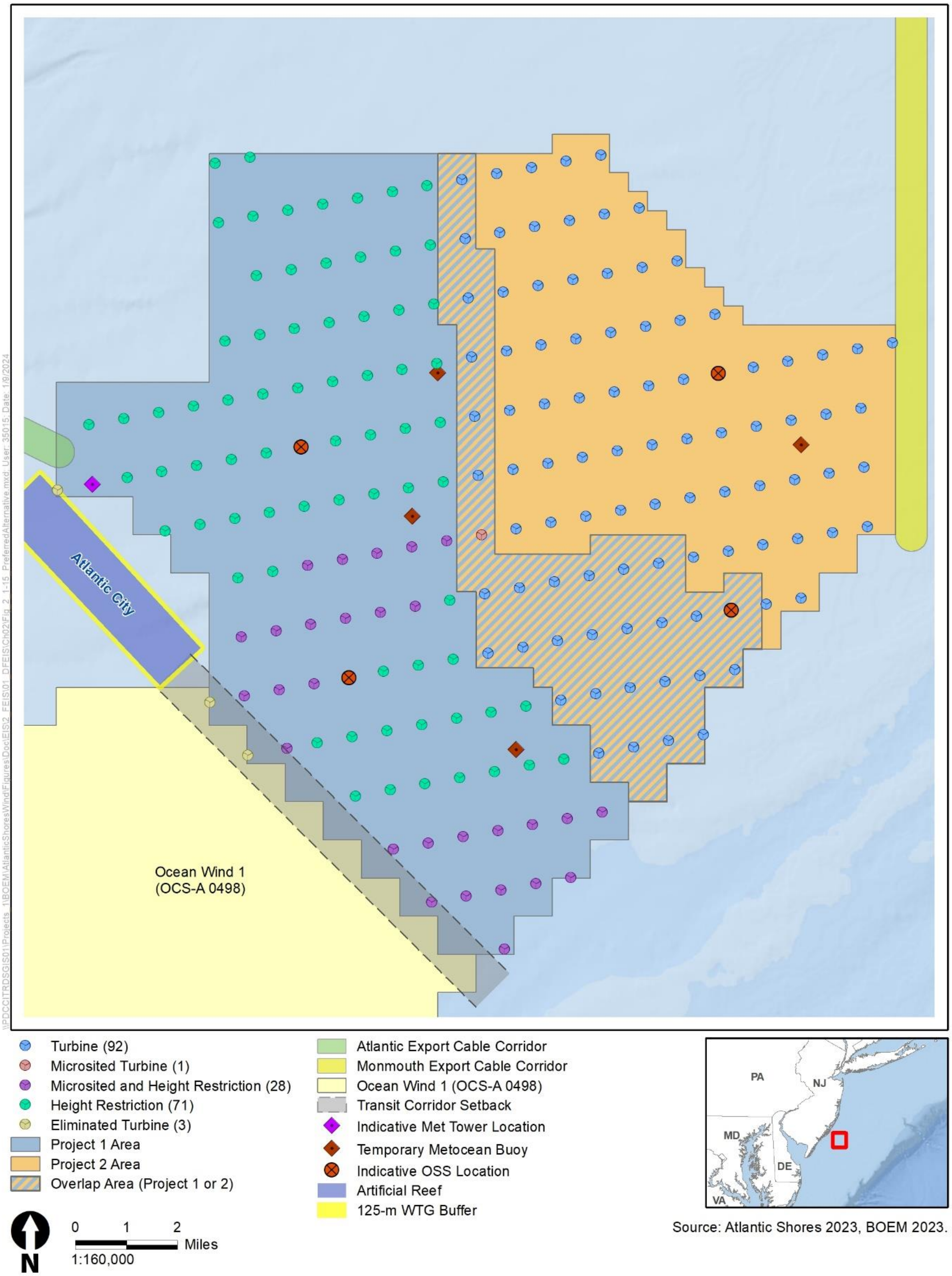
The Preferred Alternative, as shown in Figure 2.1-18, would include up to 195[10] WTGs (between 105 and 130 WTGs for Project 1, and between 64 and 93 WTGs for Project 2), up to 10 OSSs (up to 5 in each Project), up to 1 permanent met tower (Project 1), and up to 4 temporary metocean buoys (up to 3 metocean buoys in Project 1; 1 metocean buoy in Project 2), interarray and interlink cables, 2 onshore substations and/or converter stations, 1 O&M facility, and up to 8 transmission cables making landfall at two New Jersey locations: Sea Girt and Atlantic City. No permanent structures would be placed in a way that narrows any linear rows and columns to fewer than 0.6 nautical mile (1.1 kilometers) by 1 nautical mile (1.9 kilometers) or in a layout that eliminates two distinct lines of orientation in a grid pattern and the removal of a single turbine approximately 150 to 200 feet (46 to 61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site).The total number of permanent structures constructed (WTGs, OSSs, and met tower) would not exceed 197.

---

[9] USCG has determined that 0.6 nautical mile (1.1 kilometers) is the minimum spacing between WTGs for vessels to safely maneuver within a wind farm (USCG 2020).
[10] 195 WTGs assumes that 197 total positions are available, and that a minimum of 1 OSS is constructed in each Project, with 195 remaining positions available for WTGs. Fewer WTGs may be constructed to allow for placement of additional OSSs and a met tower on grid.

The Preferred Alternative would require the proposed OSSs, met tower, and WTGs to be aligned in a uniform grid with rows in an east-northeast to west-southwest direction spaced 1.0 nautical mile (1.9 kilometers) apart and rows in an approximately north to south direction spaced 0.6 nautical mile (1.1 kilometers) apart; remove a single turbine approximately 150–200 feet (45.8–61 meters) from the observed Fish Haven (Atlantic City Artificial Reef Site); microsite 29 WTGs, 1 OSS, and associated interarray cables outside of the 1,000-foot (305-meter) buffer of the ridge and swale features within the NMFS-identified AOC 1 and AOC 2, restrict the height of WTGs in Project 1 to a maximum hub height of 522 feet (159 meters) AMSL and maximum blade tip height of 932 feet (284 meters) AMSL, and provide a minimum 0.81-nautical mile (1,500-meter) setback between the WTGs in Atlantic Shores South and the WTGs in Ocean Wind 1 (Lease Area OCS-A 0498) by removing two WTGs and micrositing one WTG from Project 1.

The Preferred Alternative is identified to let the public know which alternative BOEM, as the lead agency, is leaning toward before an alternative is selected for action when a ROD is issued. No final agency action is being taken by the identification of the Preferred Alternative, and BOEM is not obligated to select the Preferred Alternative.



Source: Atlantic Shores 2023, BOEM 2023.

Figure 2.1-18. Preferred Alternative

2.2 Alternatives Considered but Not Analyzed in Detail

Under NEPA, a reasonable range of alternatives framed by the purpose and need must be developed for analysis for any major federal action. The alternatives should be "reasonable," which DOI has defined as those that are "technically and economically practical or feasible and meet the purpose and need of the proposed action."[11] There should also be evidence that each alternative would avoid or substantially lessen one or more potential, specific, and significant socioeconomic or environmental effects of the project.[12] Therefore, alternatives that could not be implemented if they were chosen (for legal, economic, or technical reasons), or do not resolve the need for action and fulfill the stated purpose in taking action to a large degree, are not considered reasonable.

BOEM considered alternatives to the Proposed Action that were identified through coordination with cooperating and participating agencies and through public comments received during the public scoping period for the EIS. BOEM then evaluated the alternatives identified, and dismissed from further consideration the alternatives that did not meet BOEM's screening criteria.[13] Consistent with the screening criteria, an alternative was considered but not analyzed in detail if it met any of the following criteria:

- It does not respond to BOEM's purpose and need.
- It results in activities that are prohibited under the lease (e.g., requires locating part, or all, of the wind energy facility outside of the lease area, or constructing and operating a facility for another form of energy).
- It is inconsistent with the federal and state policy goals below:
    - The United States' policy under the OCSLA to make OCS energy resources available for expeditious and orderly development, subject to environmental safeguards.
    - EO 14008, Tackling the Climate Crisis at Home and Abroad, issued on January 27, 2021.
    - The shared goal of the Departments of Interior, Energy and Commerce to deploy 30 GW of offshore wind in the United States by 2030, while protecting biodiversity and promoting ocean co-use.
    - The goals of affected states, including state laws that establish renewable energy goals and mandates, where applicable.

---

[11] 43 CFR 46.420(b)

[12] 43 CFR 46.415(b)

[13] See BOEM's *Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act (NEPA)* published June 22, 2022, and available at: https://www.boem.gov/sites/default/files/documents/renewable-energy/BOEM%20COP%20EIS%20Alternatives-2022-06-22.pdf.

- It is inconsistent with existing law, regulation, or policy; a state or federal agency would be prohibited from permitting activities required by the alternative.
- It does not meet the primary goals of the applicant.[14]
    - It proposes relocating a majority of the project outside of the area proposed by the applicant.
    - It results in the development of a project that would not allow the developer to satisfy contractual offtake obligations.
- There is no scientific evidence that the alternative would avoid or substantially lessen one or more significant socioeconomic or environmental effects of the project.
- It is technically infeasible or impractical, meaning implementation of the alternative is unlikely given past and current practice, technology, or site conditions as determined by BOEM's technical experts.
- It is economically infeasible or impractical, meaning implementation of the alternative is unlikely due to unreasonable costs as determined by BOEM's technical and economic experts.
- It is environmentally infeasible, meaning implementation of the alternative would not be allowed by another agency from which a permit or approval is required, or implementation results in an obvious and substantial increase in impacts on the human environment that outweighs potential benefits.
- The implementation of the alternative is remote or speculative; or it is too conceptual in that it lacks sufficient detail to meaningfully analyze impacts; or there is insufficient available information to determine whether the alternative is technically feasible.
- It has a substantially similar design to another alternative that is being analyzed in detail.
- It would have a substantially similar effect as an alternative that is analyzed in detail.

Table 2-6 presents the alternatives considered but not analyzed in detail with a brief discussion of the reasons for their elimination in accordance with CEQ regulations at 40 CFR 1502.14(a), DOI regulations at 43 CFR 46.420(b)-(c).

[14] For a project without an existing offtake agreement, such as Project 2 within the Atlantic Shores South Project, BOEM should determine whether the project is currently being reviewed as part of a competitive offtake award, or whether it plans to compete for an award during the EIS development, and identify the minimum nameplate capacity required to remain eligible for these awards. This minimum nameplate capacity may be used as an applicant's primary goal. Atlantic Shores has established a target size of 1,327 MW for Project 2, which aligns with the interconnection service agreements and interconnection construction service agreements Atlantic Shores intends to execute with PJM.

Table 2-6. Alternatives considered but not analyzed in detail

Alternative Dismissed	Justification for Dismissal
Wind Farm Location and Generating Capacity	
Project Relocation to the Hudson South Lease Area or farther offshore	Commenters suggested BOEM relocate the Project or turbines. This would be covered under the No Action Alternative. Atlantic Shores has been granted the right to submit a COP for a project located within the geographic area identified as Lease Area OCS-A 0499. Evaluating an alternate location for the wind energy facility outside of the Lease Area would constitute a new Proposed Action and would not meet BOEM's purpose and need to respond to Atlantic Shores' proposal and determine whether to approve, approve with modifications, or disapprove the COP to construct, operate and maintain, and decommission a commercial-scale offshore wind energy facility within the Lease Area. BOEM's regulations require BOEM to analyze Atlantic Shores' proposal to build commercial-scale wind energy facilities in the Lease Area. BOEM would consider proposals on other existing leases through a separate regulatory process. This alternative would effectively be the same as selecting the No Action Alternative.
Wind Turbine Array Layout and Spacing	
Realistic Minimum Design scenario required to meet the purpose and need of the Project while minimizing negative impacts on the environment	A commenter requested that BOEM analyze alternative projects of differing sizes and designs. This alternative would not address a specific environmental or socioeconomic concern and it would likely have substantially similar effects when analyzed in detail as other action alternatives (e.g., habitat and visual minimization). It is also too conceptual and speculative in that it lacks sufficient detail to enable BOEM to meaningfully analyze impacts.
Restrict WTG Locations within the Southern Portion of the Lease Area within the range of 17.3 to 19.3 miles (27.8 and 31.1 kilometers) from shore	In order to mitigate visual impacts and reduce noise in the North Atlantic right whale migration corridor, commenters suggested that BOEM restrict siting of the WTGs to between 17.3 and 19.3 miles (27.8 and 31.1 kilometers) from the shoreline. This alternative, restricting turbines between 17.3 and 19.3 miles (27.8 and 31.1 kilometers) from shore, would retain 31 turbines (Figure 2.2-1). This would lead to an 85% reduction in turbines. This alternative was not carried forward for detailed analysis because it would negate Atlantic Shores' ability to fulfill the terms of BPU Order (Docket Nos. QO20080555 and QO21050824) for 1,510 MW and would not meet the purpose and need.
Restrict WTG Locations within the Southern Portion of the Lease Area to beyond 17.3 miles (27.8 kilometers) from shore	To mitigate visual impacts, commentors suggested that BOEM prohibit placing the WTGs within 17.3 miles (27.8 kilometers) from shore. This alternative, restricting turbines to be located more than 17.3 miles (27.8 kilometers) from the shoreline, would retain 98 turbines (Figure 2.2-2). This would lead to a 51% reduction in turbines. This alternative was not carried forward for detailed analysis because it would negate Atlantic Shores' ability to fulfill the terms of BPU Order (Docket Nos. QO20080555 and QO21050824) for 1,510 MW and would not meet the purpose and need.
Minimum WTG Spacing Using a 2-Nautical-Mile (3,704-Meter) by 2-Nautical-Mile (3,704-Meter) Wind Turbine Layout to provide safe access for fishing vessels	Commenters suggested that BOEM analyze an alternative WTG layout with 2-nautical-mile (3,704-meter) spacing between WTGs. As illustrated on Figure 2.2-3, 2-nautical-mile (3,704-meter) spacing would provide for 38 WTG positions. This would lead to an 81% reduction in turbines. This alternative was not carried forward for detailed analysis because it would negate Atlantic Shores' ability to fulfill the terms of BPU Order (Docket Nos. QO20080555 and QO21050824) for 1,510 MW and would not meet the purpose and need.

Alternative Dismissed	Justification for Dismissal
Consistent Wind Turbine Spacing and Layout with Ocean Wind 1 and Adjacent Projects to provide consistent straight-line routes for mariners	One commenter requested that BOEM consider an alternative that would create a uniform turbine spacing and layout across the adjacent Atlantic Shores South and Ocean Wind 1 projects to help facilitate navigation safety, consistent and continuous marking and lighting, search and rescue, and, where necessary, other uses such as commercial fishing. However, the turbine layouts and spacing within the Atlantic Shores South and Ocean Wind 1 Lease Areas were designed to accommodate the predominant vessel traffic patterns unique to each Lease Area. Vessel traffic patterns differ for each Lease Area, and a uniform grid spacing across the adjacent projects would not maintain the predominant vessel traffic patterns established by users within each Lease Area. Atlantic Shores evaluated layout orientations that minimized impacts on existing maritime uses and evaluated the technical consideration of the wind resource and power production in determining the proposed layout. To achieve the objectives of providing a distinct visual separation and facilitating safe navigation across the two adjacent projects, while also maintaining the layout of the Proposed Action, which accommodates predominant vessel traffic patterns, BOEM, in consultation with USCG, developed Alternative E (Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1), which analyzes a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Atlantic Shores South and the WTGS in the Ocean Wind 1 Lease Areas. Alternative E addresses the need for a setback in the absence of uniform grid spacing, while maintaining a layout that accommodates the predominant vessel traffic patterns in the Lease Area. This alternative would have a substantially similar design and effect as Alternative E and would be less responsive to local traffic patterns and USCG input than Alternative E, while also requiring a disruptive and inefficient redesign of the proposed Project layout; therefore, uniform grid spacing was eliminated from detailed consideration.
2.2-Nautical-Mile (4,074-Meter) to 4-Nautical-Mile (7,408-Meter) Separation between the Atlantic Shores South and Ocean Wind 1 Projects	One commenter recommended that a 2.2-nautical-mile (4,074-meter) to 4-nautical-mile (7,408-meter) transit corridor be established between the Atlantic Shores South and Ocean Wind 1 projects to preserve traditional transit paths through the Lease Areas to access fishing grounds. BOEM evaluated separation distances between the Atlantic Shores South and Ocean Wind 1 projects. As the length traveled along the boundary between the Atlantic Shores South and Ocean Wind 1 projects would be approximately 7 nautical miles (12,964 meters) and there would be additional paths along the predominant inshore-offshore routes through the array to allow for traffic dispersal, BOEM, through coordination with USCG, determined that a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) separation between the WTGs in the Atlantic Shores South and the WTGs in the Ocean Wind 1 projects, as analyzed in Alternative E, was adequate to accommodate inshore-offshore vessel traffic, as well as changes in path or orientation as vessels transit between the two adjacent projects. According to USCG, 0.8 nautical mile (1,500 meters) to 1.08 nautical miles (2,000 meters) is also an acceptable distance for its sea and air assets to adjust their path as they move between the two adjacent projects. Alternative E analyzes a 0.81-nautical-mile (1,500-meter) to 1.08-nautical-mile (2,000-meter) setback between WTGs in the Atlantic Shores South and Ocean Wind 1 Lease Areas with the intent that both Atlantic Shores South

Alternative Dismissed	Justification for Dismissal
	and Ocean Wind 1 would implement wind turbine layout modifications to result in a combined separation distance of 0.81 nautical mile (1,500 meters) to 1.08 nautical miles (2,000 meters). Alternative E addresses the aim to reduce impacts on navigation and access to commercial and recreational fishing grounds. In addition, as illustrated in Figures 2.2-4 and 2.2-5, this alternative would result in a 6 to 14% reduction of turbines within the Atlantic Shores South Lease Area. Alternative E analyzes a buffer while maintaining a layout orientation that accommodates the predominant vessel traffic patterns in the Atlantic Shores South Lease Area. Therefore, this alternative was not carried forward for detailed analysis.
Artificial Reef Avoidance Buffers for WTG Installation	Comments received from MAFMC and NEFMC recommended that the Project be sited to avoid the Atlantic City Reef. No WTGs would be placed within 410 feet (125 meters) of the Atlantic City Reef. This alternative would lead to the removal or relocation of 1 WTG (Figure 2.2-6). BOEM determined that this alternative would be more suitable to address as a Project mitigation measure. Refer to Appendix G for BOEM's recommended measures to avoid or minimize impacts on artificial reefs through WTG installation.
Artificial Reef Avoidance Buffers for Cable Installation	Comments received from MAFMC and NEFMC recommended that the project be sited to avoid the Atlantic City Reef. A 246-foot (75-meter) buffer would be established for cable installation around artificial reef sites to reduce potential impacts on the artificial reefs from turbidity and sedimentation (Figure 2.2-7). The export cable to the Monmouth Landing site would not be placed within 246 feet (75 meters) of the Manasquan Inlet or the Axel Carlson artificial reefs. A 246-foot (75-meter) buffer would allow a total of approximately 1,640 feet (500 meters) for Atlantic Shores to install up to five export cables as part of the proposed Monmouth ECC. However, 1,640 feet (500 meters) does not provide adequate cable spacing (328–656 feet [100–200 meters] between each cable) to account for cable repairs or localized cable routing that may be required. A 246-foot (75-meter) buffer could prevent the use of the Monmouth ECC and thereby make the interconnection of Project 1 or Project 2 to the Larrabee Substation infeasible, which in turn, would make the Project technically infeasible. The Project's proposed ECCs are sited to avoid significant marine constraints and protected resources, including the boundaries of the artificial reefs. In addition, the proposed ECCs are sited to ensure cable constructability and reliability, as well as minimize impacts on marine users. See *Export Cable Corridors that Minimize Navigational Conflicts* rationale below for additional justification.
Wind Turbine Technology	
Vertical Turbine Design in which the towers revolve without moving blades	A commenter recommended that BOEM explore the use of the vertical turbine design for the planned WTGs. As this technology is unproven and has not been fully researched or used in a commercial project, it is not technically feasible to analyze as an alternative.

Alternative Dismissed	Justification for Dismissal
Project Alteration	
Approve Only Project 1 or Only Project 2, But Not Both Projects	BOEM considered an alternative under which BOEM would approve only Project 1 or Project 2, but would not approve both projects. Atlantic Shores' proposal for two projects relies on economies of scale, including: procurement of components and services for two similarly designed projects in similar geographic and environmental conditions; shared execution contractors; enabling sharing of design, engineering, and project management costs across two projects; coordinated pre- and post-construction environmental and geophysical and geotechnical survey campaigns; fewer separate mobilizations and de-mobilizations. Further, the uncertainty regarding (1) the boundary between Projects 1 and 2; (2) which WTG and OSS positions would be allocated to which Project; and (3) the POIs and export cable routes available for interconnection among the two Projects necessitates their joint analysis by federal agencies because agency decisions regarding Project 1 will directly influence the final PDE for Project 2. To illustrate, Atlantic Shores has made financially significant firm commitments as part of the Atlantic Shores Project 1 Interconnection Services Agreement and Interconnection Construction Studies Agreements to connect at the Cardiff POI, which would be forfeited if Project 1 were not approved while Project 2 was approved. Project 2 could not be simply substituted for Project 1 in this scenario. Finally, this alternative would not meet BOEM's purpose and need "to determine whether to approve, approve with modifications, or disapprove Atlantic Shores' COP to construct and install, operate and maintain, and decommission two commercial-scale offshore wind energy projects within the Lease Area." In particular, the Atlantic Shores South Projects 1 and 2 combined could contribute approximately 2.5 GW to New Jersey's goal of 11 GW of offshore wind energy generation by 2040 as outlined in New Jersey Governor's EO No. 307, issued on September 22, 2022. In pursuit of this goal, BPU has outlined a series of solicitations for 1,200 MW of electricity and above through 2030, with existing awards made consistently above 1,100 MW per project. If only Project 1 was approved, Atlantic Shores would not be able to bid Project 2 into these upcoming solicitations which would undermine the achievement of New Jersey's goals by reducing competition and the supply of potential areas for offshore wind projects.
Offshore Export Cables	
Shared Cable Corridor routing that uses common corridors with adjacent projects such as the Atlantic Shores South and Ocean Wind 1 projects	Commenters recommended that BOEM consider ECC routing alternatives that would have adjacent projects (i.e., Atlantic Shores South and Ocean Wind 1) use a shared cable corridor. BOEM cannot dictate that a lessee use a shared cable corridor. 30 CFR 585.200(b) states that, "A lease issued under this part confers on the lessee the rights to one or more project easements without further competition for the purpose of installing, gathering, transmission, and distribution cables; pipelines; and appurtenances on the OCS as necessary for the full enjoyment of the lease." BOEM cannot limit a lessee's right to a project easement when a shared cable corridor does not exist and there is no way of determining if the use of a future shared cable corridor would be a technically and economically practical and feasible alternative for the project. Therefore, BOEM cannot require Atlantic Shores to use a future shared cable corridor for this Project. Furthermore, the Atlantic Shores South Project's export cables would connect to the power grid via different onshore substations

Alternative Dismissed	Justification for Dismissal
	than Ocean Wind 1. Developing a shared ECC would not be technically or economically practicable because the Atlantic Shores South and Ocean Wind 1 projects have distinct interconnection points to the electric power grid. At this time this alternative is not technically or economically feasible as the POIs associated with the cable corridors would be unable to accept the total MW capacity produced by both Atlantic Shores South and Ocean Wind 1, and the delays and costs of switching or gaining approval to upgrade the necessary POIs for a shared cable corridor would not allow Atlantic Shores to meet deadlines in its agreement with BPU. See the following *Single Cable Corridor* rationale for additional justification. There are currently potential transmission proposals under review by BPU to support the plan for 11 GW of offshore wind by 2040, which may be able to help further address this comment in the future.
Single Cable Corridor routing that uses a single ECC for Project 1 and Project 2	Comments received from the Garden State Seafood Association expressed concern about the multiple export cable routes and recommended that BOEM consider the use of a single cable corridor for Project 1 and Project 2 with the shortest route to shore. Due to electrical capacity constraints at the target POIs, Atlantic Shores determined that two POIs are needed to accommodate the expected amount of electricity that could be generated by Project 1 and Project 2 (estimated to be at least 2.8 GW). Project 1's nameplate capacity is 1,510 MW and is associated with the existing Cardiff POI. The existing Cardiff POI ROW does not have the physical capacity to fit the cables for both projects, thus additional cable landing location(s) and ROWs would be necessary if both projects were combined into the Cardiff POI. This, in turn, would lead to added expense and delays for Project 2, the nameplate capacity of which is not yet determined, but for which Atlantic Shores has a goal of 1,327 MW. In addition, upgrading the existing Cardiff POI would require additional interconnection studies and modifications to the onshore engineering design, which would lead to an additional 5–10-year delay and would not enable Atlantic Shores to meet its Project 1 delivery schedule, as defined by BPU Order (Docket Nos. QO20080555 and QO21050824). Thus, it would be economically infeasible to adjust the current plans to accommodate the use of a single ECC. The delays would jeopardize the viability of the Atlantic Shores South Project, ultimately causing the Project to not meet the purpose and need.
Export Cable Corridors that Minimize Navigational Conflicts	A comment received from the New York State Department of State requested that the area occupied by the ECCs be minimized within the existing vessel traffic routes. BOEM was not able to identify an alternate technically feasible route due to multiple conflicts near the landfall site, inclusive of fiber optic cables, ocean disposal sites, federal and state sand resource areas, and sand borrow areas, and the lack of available data that would demonstrate feasibility for cable installation and burial. Thus, an alternate technically feasible route is speculative. The Project's proposed ECCs are sited to avoid significant marine constraints and protected resources, ensure cable constructability and reliability, and minimize impacts on marine users. In addition, reduction of the risk of the potential for a vessel to snag a cable with its anchor and incur liability and other navigational conflicts could be addressed by defining the cable easement(s) within the ECCs, which typically occurs with COP

Alternative Dismissed	Justification for Dismissal
	approval; as well as during the final review of the Cable Burial Risk Assessment that occurs during the Final Design Report and Fabrication and Installation Report review. As a result, an alternate technically feasible route, if it exists, is unlikely to confer a substantial environmental or socioeconomic advantage over the routes included as part of the Proposed Action. Proposing a new ECC on unsurveyed areas would require additional data to be collected and a detailed analysis to be undertaken to determine the economic and environmental feasibility of the proposed cable route. This would result in a delay of a year or more, rendering the Project economically infeasible. Therefore, this alternative was not carried forward for detailed analysis.
Onshore Infrastructure	
Onshore infrastructure that Minimizes Land Use Conflicts	BOEM was not able to identify alternate technically feasible landfall locations, POIs, or onshore interconnection cable routes due to multiple physical and capacity constraints (COP Volume I, Appendix I-G; Atlantic Shores 2024). The Project's proposed landfall sites were selected based on location (within the maximum distance for HDD to reach beyond the top-of-slope of the beach), size (the amount of space needed to transition between offshore and onshore cables), and existing infrastructure and land use (i.e., undeveloped or limited to surface development [such as parking lots]). The Project's proposed POIs were selected based on location and capacity. The Project's proposed onshore interconnection cable route options were sited to avoid submerged aquatic vegetation, unsuitable terrain, existing utility corridors, and high population densities. In addition, the route options were sited to limit disturbance to existing land uses, minimize the number of hard route angles, and minimize the overall route length. As a result, alternate technically feasible landfall locations, POIs, and onshore cable routes, if they exist, are unlikely to confer a substantial environmental or socioeconomic advantage over the onshore infrastructure sites included as part of the Proposed Action. Furthermore, as explained in the *Single Cable Corridor* rationale in this table, additional interconnection studies and modifications to the onshore engineering design would lead to an additional multi-year delay, rendering the Project economically infeasible. Therefore, this alternative was not carried forward for detailed analysis.

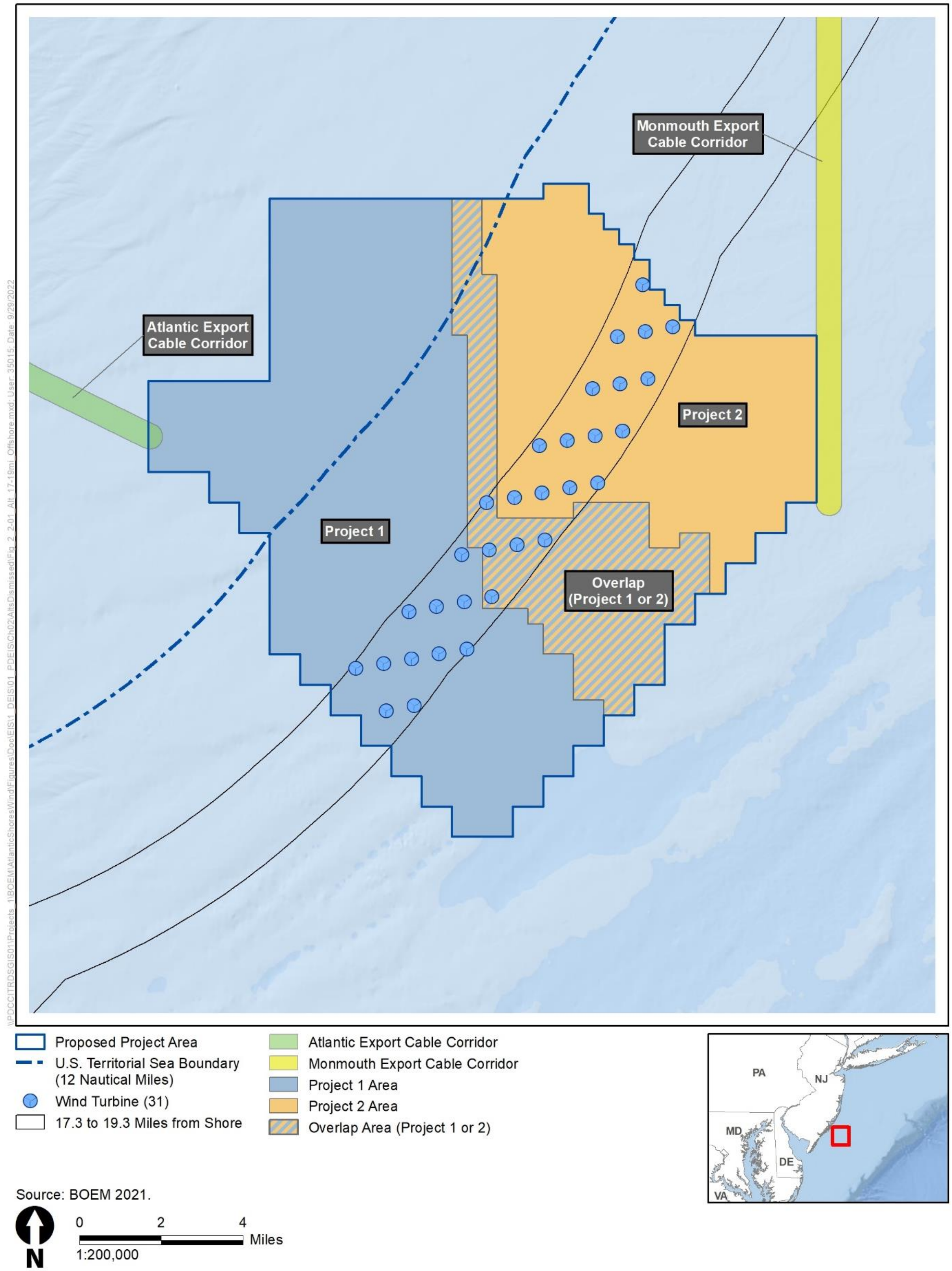


Figure 2.2-1. Restrict WTG locations within the southern portion of the Lease Area within the range of 17.3 to 19.3 miles (27.8 to 31.1 kilometers) from shore

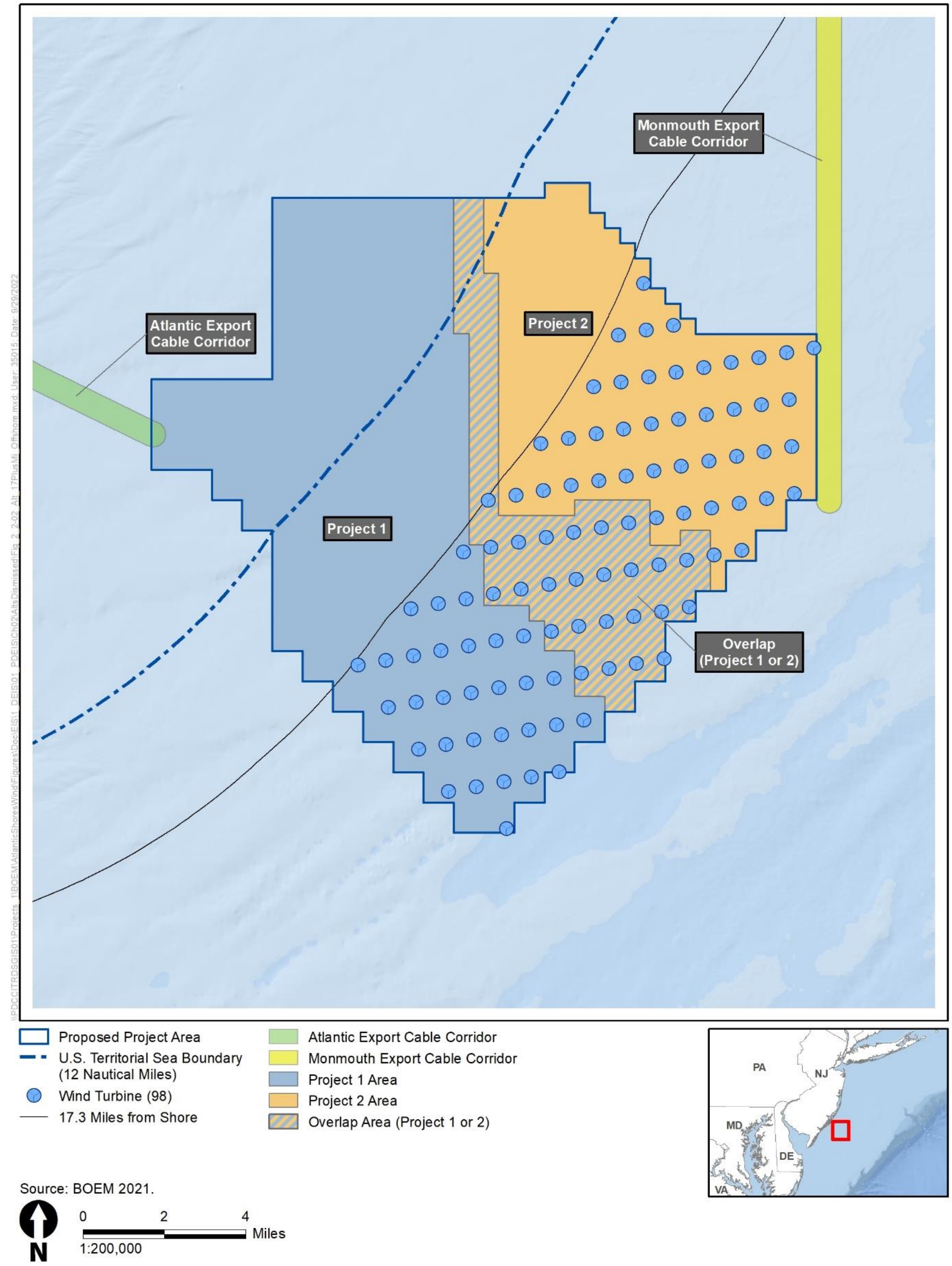


Figure 2.2-2. Restrict WTG locations within the southern portion of the Lease Area to beyond 17.3 miles (27.8 kilometers) from shore

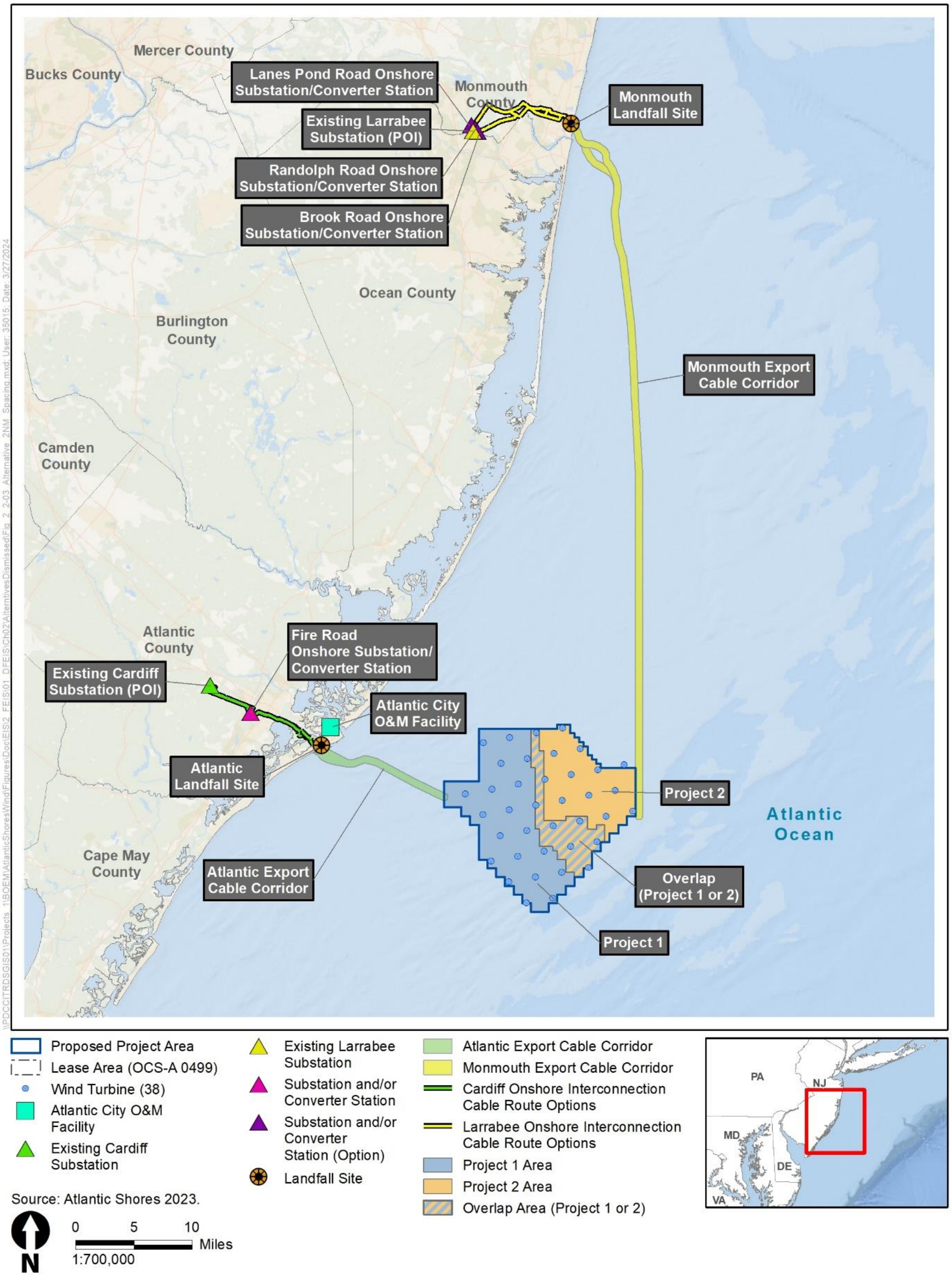


Figure 2.2-3. Minimum WTG spacing using a 2-nautical mile (3,704-meter) by 2-nautical mile (3,704-meter) wind turbine layout to provide safe access for fishing vessels

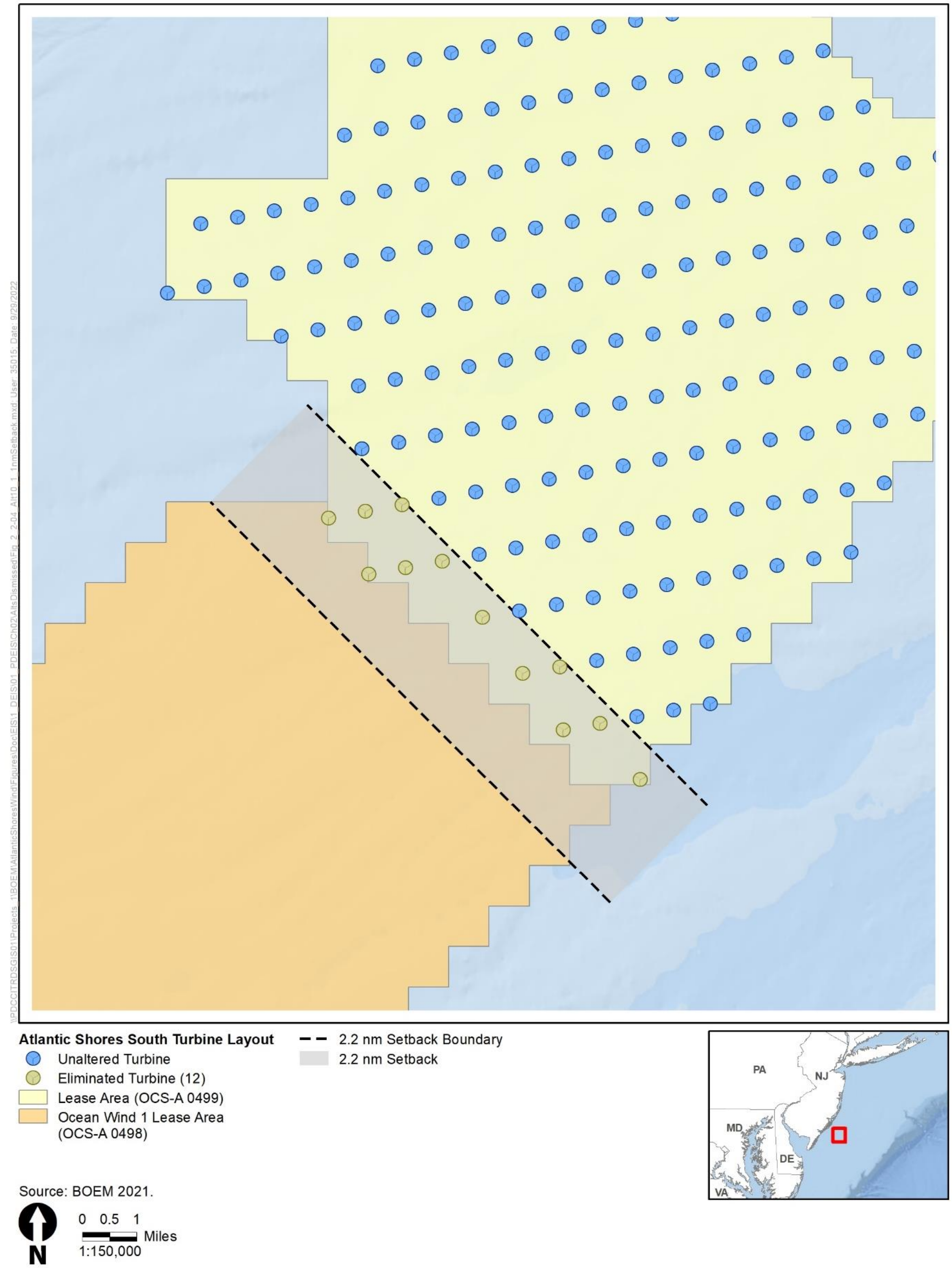


Figure 2.2-4. 2.2-nautical-mile (4,074-meter) separation between the Ocean Wind 1 and Atlantic Shores South projects

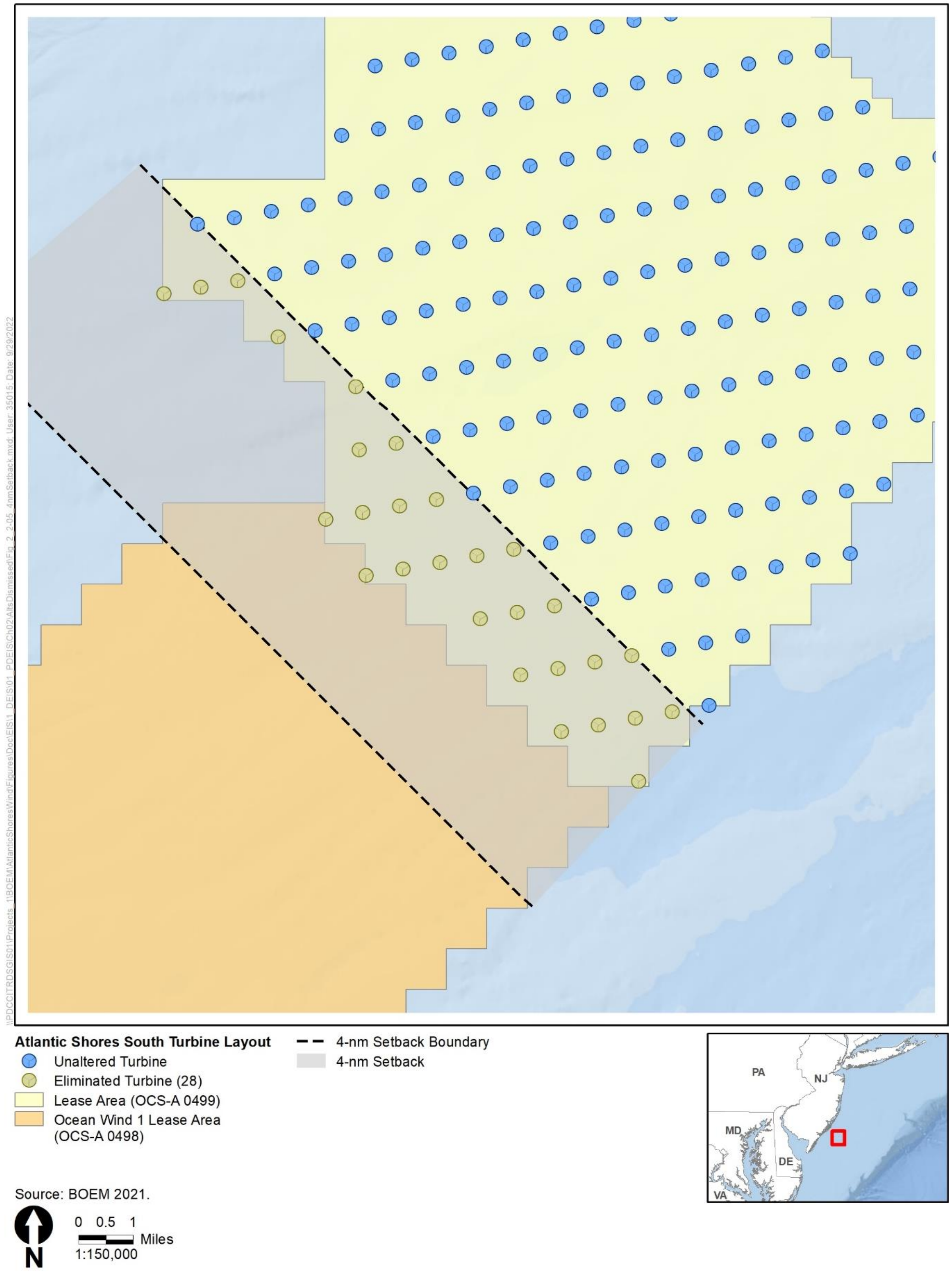
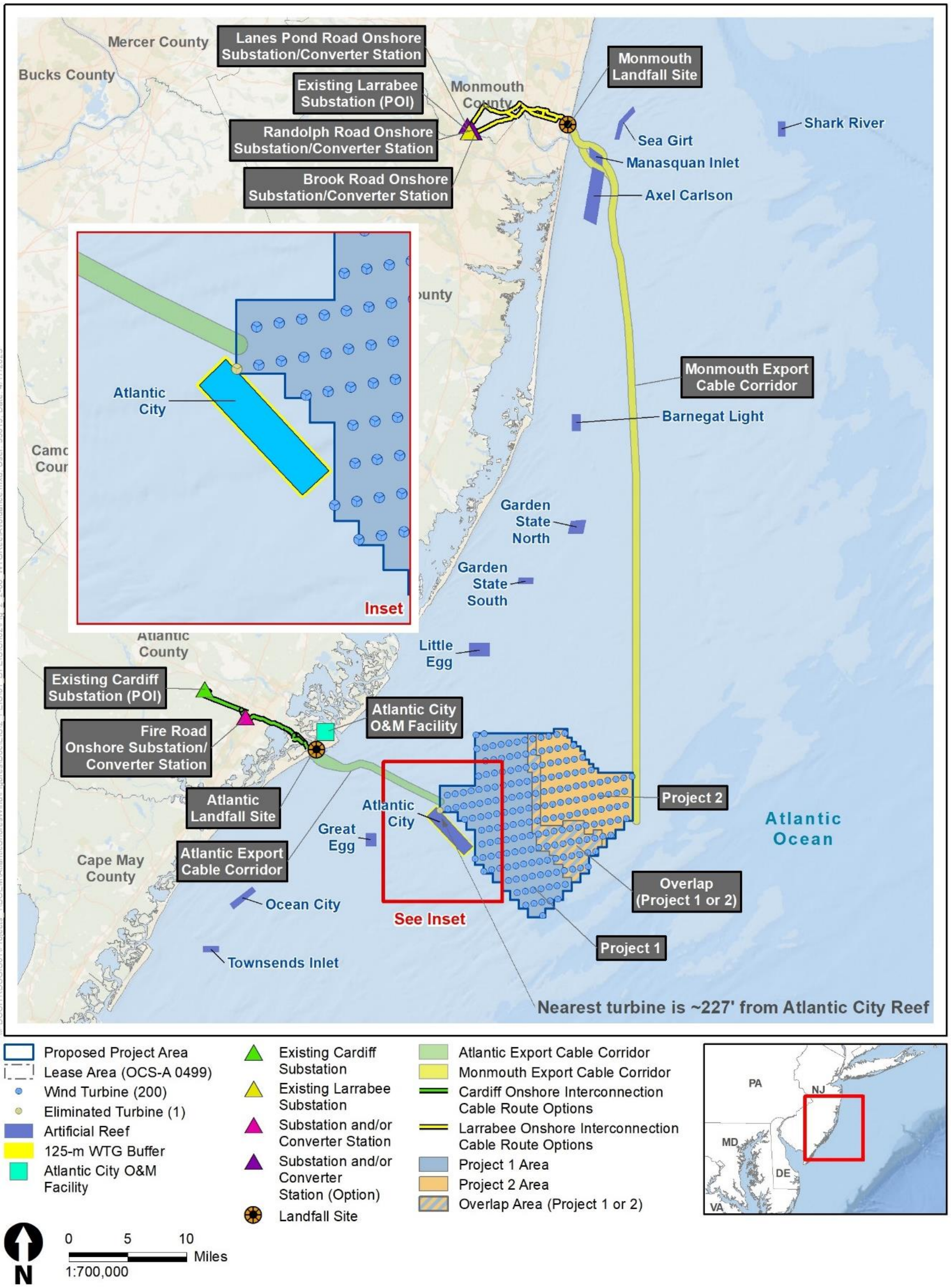
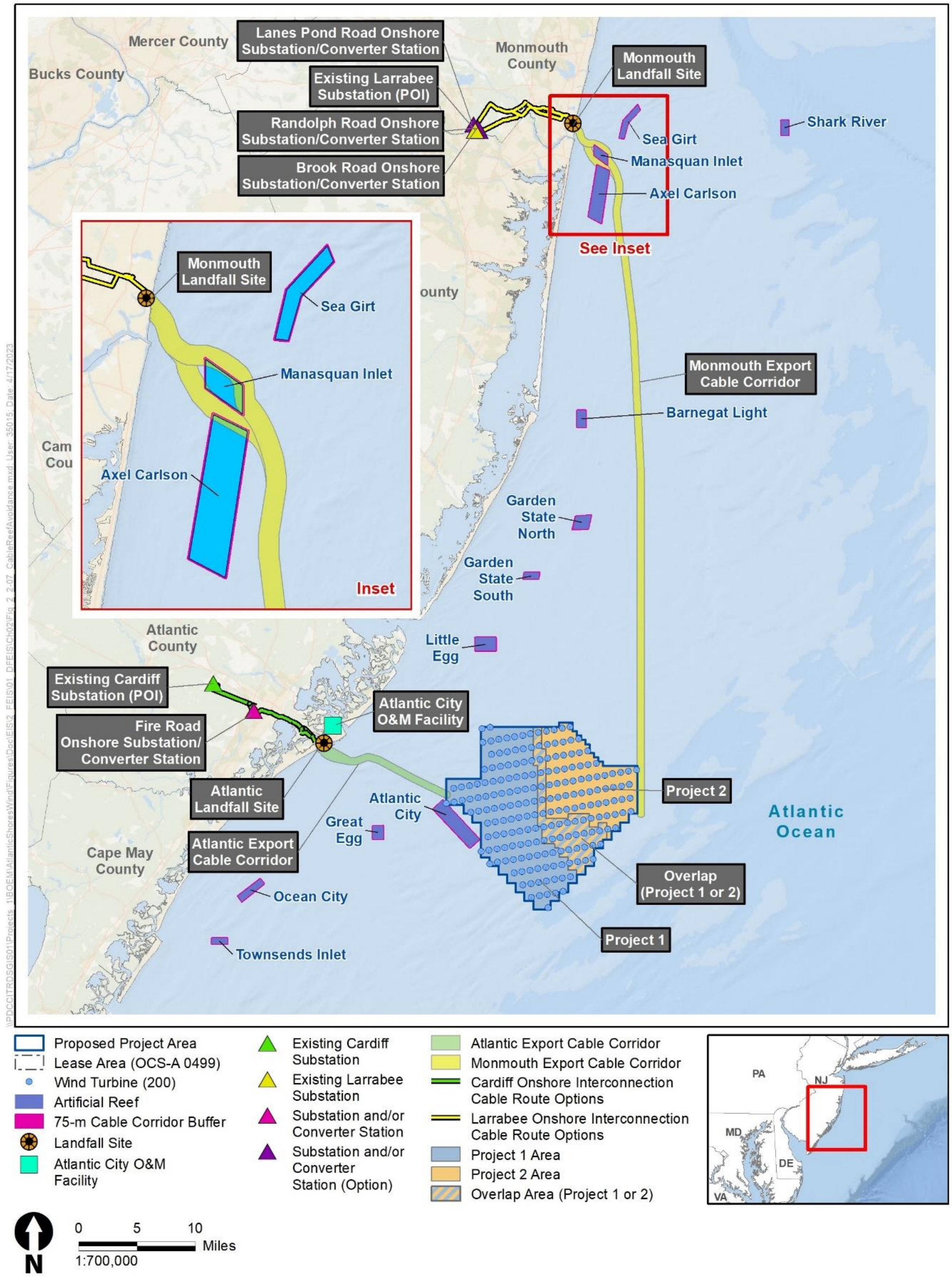


Figure 2.2-5. 4-nautical-mile (7,408-meter) separation between the Ocean Wind 1 and Atlantic Shores South projects



Source: Atlantic Shores 2023, NJGIN 2021.

Figure 2.2-6. Artificial reef avoidance buffers for WTG installation



Source: Atlantic Shores 2023, NJGIN 2021.

Figure 2.2-7. Artificial reef avoidance buffers for cable installation

2.3 Non-Routine Activities and Low-Probability Events

Non-routine activities and low-probability events associated with the proposed Project could occur during construction and installation, O&M, or decommissioning. Examples of such activities or events could include corrective maintenance activities, collisions involving vessels or vessels and marine life, allisions (a vessel striking a stationary object) involving vessels and WTGs or OSSs, cable displacement or damage by anchors or fishing gear, chemical spills or releases, severe weather and other natural events, seismic activities, and terrorist attacks. These activities or events are impossible to predict with certainty. This section provides a brief assessment of each of these potential events or activities.

- *Corrective maintenance activities:* These activities could be required as a result of other low-probability events, or as a result of unanticipated equipment wear or malfunctions. Atlantic Shores anticipates housing spare parts for key Project components at an O&M facility to initiate repairs expeditiously.
- *Collisions and allisions:* These could result in spills (described below) or injuries or fatalities to wildlife (addressed in Chapter 3, *Affected Environment and Environmental Consequences*). Collisions and allisions are anticipated to be unlikely based on the following factors that would be considered for the proposed Project:
    - USCG requirements for lighting on vessels
    - NOAA vessel speed restrictions
    - The proposed spacing of WTGs and OSSs
    - The inclusion of proposed Project components on navigation charts
- *Cable displacement or damage by vessel anchors or fishing gear:* This could result in safety concerns and economic damage to vessel operators and may require corrective action by Atlantic Shores such as the need for one or more cable splices to an export or interarray cable(s). However, such incidents are unlikely to occur because the proposed Project area would be indicated on navigational charts, and the cable would be buried to the target depth of 5 to 6.6 feet (1.5 to 2.0 meters) or protected with rock placement, concrete mattresses, rock bags, grout-filled bags, or half-shell pipes. Additionally, Atlantic Shores would employ a monitoring system on its export cables that would be able to provide advance warning of any potential cable failures due to insulation degradation, physical damage, or other causes. In the event that a fault is detected, the fault would be isolated, and diagnostics would be performed to precisely locate the position of the fault. The damaged section of the export cable would then be recovered to a vessel, the damaged section of cable would be removed, and a new section of cable would be spliced in to replace the damaged section. Finally, the cable would be returned to the seabed and buried.
- *Chemical spills or releases:* For offshore activities, these include inadvertent releases from refueling vessels, spills from routine maintenance activities, and any more significant spills as a result of

a catastrophic event. All vessels would be certified by the Project to conform to vessel O&M protocols designed to minimize risk of fuel spills and leaks. Atlantic Shores has prepared an Oil Spill Response Plan (OSRP) and would be expected to comply with USCG and BSEE regulations relating to prevention and control of oil spills. Onshore, releases could potentially occur from construction equipment or HDD activities. All wastes generated onshore would comply with applicable state and federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous Materials regulations.

- *Severe weather and natural events:* The Atlantic Shores Offshore and Onshore Project areas are subject to extreme weather, such as storms and hurricanes, which may impose hydrodynamic load and sediment scouring (COP Volume II, Section 2.2.1.5, Atlantic Shores 2024). The return rate of hurricanes may become more frequent than the historical record, and the future probability of a major hurricane will likely be higher than the historical record of these events due to climate change (see Appendix B.1.4, *Hurricanes and Tropical Storms*).

  Wind turbines are engineered, designed, fabricated, installed, maintained, and inspected to ensure their structural integrity for the life of the structure. These structures are built with a safety factor providing a conservative design to mitigate against any stresses, loads, or fatigue. The WTGs come with safety functions and control systems in-built to enhance their structural reliability. Critical parameters such as wind speed and wind direction changes, WTG vibrations, etc. are continuously monitored to keep the WTG either in an idle or an operational mode and to maintain the blade pitch and/or the turbine yaw within the designed limits. Scheduled or unscheduled maintenance would likely occur and would most likely be dependent on the operator and/or manufacturer.

  Atlantic Shores has committed to adhering to IEC 61400, an international standard regarding WTGs. The engineering specifications of the WTGs and their ability to sufficiently withstand weather events is independently evaluated by a certified verification agent when reviewing the Facility Design Report and Fabrication and Installation Report according to international standards, which include withstanding hurricane-level events. One of these standards calls for the structure to be able to withstand a 50-year return interval event. An additional standard includes withstanding 3-second gusts of a 500-year return interval event, which would correspond to Category 5 hurricane windspeeds. If severe weather caused a spill or release, the actions outlined above would help reduce potential impacts. Severe flooding or coastal erosion could require repairs, with impacts associated with repairs being similar to those outlined in Chapter 3 for construction activities. While highly unlikely, structural failure of a WTG (i.e., loss of a blade or tower collapse) would result in temporary hazards to navigation for all vessels, similar to the construction and installation impacts described in Chapter 3.

- *Seismic activity:* The Project area is located along the Western Atlantic continental margin, which is not an area considered tectonically active (USGS 2019). The impacts from seismic activity would be similar to those assessed for other non-routine events or activities.

- *Terrorist attacks:* BOEM considers these unlikely, but impacts could vary depending on the magnitude and extent of any attacks. The actual impacts of this type of activity would be the same as the outcomes listed above for severe weather and natural events. An Emergency Response Plan would be prepared by Atlantic Shores, in coordination with USCG, to provide clear instructions regarding procedures to be followed during emergency incident scenarios, including terrorist attacks.

2.4 Summary and Comparison of Impacts between Alternatives

Table 2-7 provides a summary and comparison of the impacts under the No Action Alternative and each action alternative assessed in Chapter 3. Under the No Action Alternative, any potential environmental and socioeconomic impacts, including benefits, associated with the proposed Project would not occur; however, impacts could occur from other ongoing and planned activities. The impacts associated with Alternatives F1, F2, and F3 will be comparable to one another during O&M. During construction and installation and decommissioning, the timing and level of disturbance of the three sub-alternatives will differ depending on the foundation type(s) selected. Section 3.1, *Impact-Producing Factors,* provides definitions for **negligible**, **minor**, **moderate**, and **major** impacts.

This page was intentionally left blank.

Table 2-7. Summary and comparison of impacts by action alternative with no mitigation measures[15]

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.4.1 Air Quality	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor to moderate** impacts on air quality. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all other planned activities (including other offshore wind activities) would result in **minor to moderate adverse** impacts due to emissions of criteria pollutants, volatile organic compounds, hazardous air pollutants (HAPs), and greenhouse gases (GHG), mostly released during construction and installation and decommissioning, and **minor to moderate beneficial** impacts on regional air quality after offshore wind projects are operational.	*Proposed Action:* The Proposed Action would have **minor to moderate adverse** impacts attributable to air pollutant, GHG emissions and accidental releases. The Project may lead to reduced emissions from fossil-fueled power-generating facilities and consequently **minor to moderate beneficial** impacts on air quality and climate. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would result in **minor to moderate adverse** impacts and **minor to moderate beneficial** impacts.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* Emissions from construction and installation of different foundation types would not differ substantially among the sub-alternatives and would be similar to the Proposed Action. The impact magnitude would remain **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor to moderate adverse** and **minor to moderate beneficial**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.4.2 Water Quality	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on water quality. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on water quality primarily due to sediment resuspension, discharges, and accidental releases. The impacts are likely to be temporary or small in proportion to the geographic analysis area. *Cumulative Impacts of the Proposed Action:* Impacts of	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities,	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities,	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other	*Alternative F:* Water quality impacts from construction and installation of different foundation types would not differ substantially among the sub-alternatives and would be similar to the Proposed Action. The impact magnitude would remain **moderate adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing

[15] All sub-alternatives were deemed to have similar impacts unless otherwise stated within the applicable column. Alternative impacts are inclusive of baseline conditions and impacts from ongoing activities for each resource as described in their respective sections in Chapter 3, *Affected Environment and Environmental Consequences*. Cumulative impacts represent alternative impacts (with the baseline) plus other foreseeable impacts.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	in **moderate adverse** impacts primarily driven by the unlikely event of a large-volume, catastrophic release.	the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** primarily due to short-term, localized effects from increased turbidity and sedimentation due to anchoring and cable emplacement during construction, and alteration of water currents and increased sedimentation during operations due to the presence of structures.	including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	offshore wind activities, would be the same as for the Proposed Action.	combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.1 Bats	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** impacts on bats. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **negligible** impacts on bats because bat presence on the OCS is anticipated to be limited and onshore bat habitat impacts are expected to be minimal.	*Proposed Action:* The Proposed Action would result in **negligible** impacts on bats. The most significant sources of potential impact would be collision mortality from operation of the offshore WTGs (although BOEM anticipates this to be rare because offshore occurrence of bats is low) and potential onshore removal of habitat. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **negligible**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would not change the number of structures within the OCS, and thereby would not have the potential to significantly reduce or increase impacts on bats. The overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **negligible**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.2 Benthic Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on benthic resources.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts from habitat disturbance; permanent habitat conversion; and behavioral changes, injury, and mortality	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. The removal, or micrositing of up to 29 WTGs and 1 OSS under Alternative C would result in a	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. The removal of up to 31 WTGs under Alternative D would result in a proportional decrease in the amount of	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. The removal of up to 5 WTGs under Alternative E would result in a proportional decrease in the amount of EMF and noise impacts and benthic habitat	*Alternative F:* Alternative F1 would result in similar impacts as the Proposed Action from installing only piled foundations: **moderate adverse** impacts, with some	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	Cumulative Impacts of the No Action Alternative: The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts from habitat degradation and conversion and **moderate beneficial** impacts from emplacement of structures (habitat conversion to hard substrate).	of benthic fauna. **Moderate beneficial** impacts would result from new hard surfaces that could provide new benthic habitat. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** and **moderate beneficial**.	proportional decrease in the amount of electromagnetic field (EMF) and noise impacts and benthic habitat disturbance and conversion related to the installation of foundations, interarray cables, and scour protection. With Alternatives C1 and C2, the Project could avoid impacts on one or both (if Alternatives C1 and C2 were combined) NMFS AOCs, both of which have pronounced bottom features and produce habitat value. Although impacts on benthic resources would be reduced under Alternative C, overall impacts on benthic resources would be similar to those under the Proposed Action: **moderate adverse** impacts, with some **moderate beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	EMF and noise impacts and benthic habitat disturbance and conversion related to the installation of foundations, interarray cables, and scour protection. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** impacts, with some **moderate beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	disturbance and conversion related to the installation of foundations, interarray cables, and scour protection. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** impacts, with some **moderate beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	**moderate beneficial** impacts. Under Alternatives F2 and F3, there would be no underwater noise impacts on benthic resources due to impact pile driving. The avoidance of impact pile-driving noise impacts would reduce overall construction and installation impacts on benthic resources under Alternatives F2 and F3 compared to the Proposed Action. Alternatives F2 and F3 would avoid pile-driving noise impacts from installing suction bucket and gravity-based foundations but would result in increased habitat conversion from larger foundations. The overall impact level for Alternatives F2 and F3 would be **minor adverse** impacts. Due to the reduction in scour protection and the beneficial hard-bottom habitat it provides, Alternatives F2 and F3 could include only **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** and **moderate beneficial**.	impacts with some **moderate beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.3 Birds	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor** impacts on birds	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on birds. The most significant sources of potential impact would be collision mortality	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action:	*Alternative F:* This alternative would not change the number of structures within the OCS, and thereby would not have the potential to significantly reduce or	*Preferred Alternative*: This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	primarily through construction of ongoing activities and climate change. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts on birds due to habitat loss from increased onshore construction and interactions with offshore developments, and **minor beneficial** impacts because of the presence of offshore structures.	from operation of the offshore WTGs and long-term but minimal habitat loss and conversion from onshore construction. The Proposed Action would also result in potential **minor beneficial** impacts associated with foraging opportunities for marine birds. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse**, as well as **minor beneficial**, primarily through the permanent impacts from the presence of structures.	same as for the Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	**moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	increase impacts on birds. The overall impact level would be the same as for the Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	same as for the Proposed Action: **moderate adverse** impacts and **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.5.4 Coastal Habitat and Fauna	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on coastal habitat and fauna, primarily through onshore construction and climate change. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts on coastal habitat and fauna through onshore construction and climate change.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on coastal habitats and fauna due to the developed and urbanized landscape that dominates the geographic analysis area and measures taken to avoid sensitive habitat, but with consideration of climate change. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** due to impacts on wildlife habitat in the geographic	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for coastal habitat and fauna. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
		analysis area, but with consideration of climate change.					
3.5.5 Finfish, Invertebrates, and Essential Fish Habitat	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on finfish, invertebrates, and essential fish habitat. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** and **minor beneficial** impacts on finfish, invertebrates, and essential fish habitat.	*Proposed Action:* The Proposed Action would result in **moderate adverse** and **minor beneficial** impacts on finfish, invertebrates, and essential fish habitat, primarily due to the disturbance of seafloor during cable emplacement and the presence of structures. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** and **minor beneficial**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would not change the number of structures within the OCS, and thereby would significantly reduce or increase most impacts on finfish, invertebrates, and essential fish habitat. Impacts due to pile-driving noise would be eliminated under Alternative F; therefore, impacts due to noise would be reduced to negligible under Alternative F compared to the moderate levels determined under the Proposed Action. The overall impact levels would still be **moderate adverse** and **minor beneficial**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as the Proposed Action.	*Preferred Alternative*: The reduction in number of WTGs and micrositing under this alternative would reduce impacts due to fewer disturbances of bottom habitats. The reduction in disturbances to complex habitats in the NMFS-identified AOCs would also benefit finfish and invertebrates that are known to be productive in these areas. These reductions of impacts are not sufficient to change the impact determinations made under Alternative B; however, avoidance and/or reduction of impacts to these resources within the AOCs is ecologically valuable. The impacts due to the Preferred Alternative would be **moderate adverse** with some **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative*: The cumulative impacts of the Preferred Alternative with ongoing and planned activities including the connected action and other offshore wind activities, would be the same as the Proposed Action.
3.5.6 Marine Mammals	*Incremental Impacts*[16]*:* None *No Action Alternative Impacts:* Continuation of	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other mysticetes, odontocetes, and pinnipeds	*Incremental Impacts:* Minor for NARW; minor to moderate for other	*Incremental Impacts:* Minor for NARW; minor to moderate for other

[16] Incremental impacts (i.e., alternative impacts without the baseline) were included at NMFS' request in order to support determinations under the MMPA.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on pinnipeds, odontocetes, and mysticetes (except for NARW) and **major adverse** impacts on NARW and could include **minor beneficial** impacts on odontocetes and pinnipeds. The No Action Alternative would have no additional incremental effect on marine mammals. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts on pinnipeds, odontocetes, and mysticetes (except for NARW) and **major adverse** impacts on NARW and could include **minor beneficial** impacts due to increased foraging opportunities for odontocetes and pinnipeds. However, these effects may be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species.	mysticetes, odontocetes, and pinnipeds *Proposed Action:* Including the baseline, the Proposed Action would result in **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds and **major adverse** impacts on NARW. **Minor beneficial** impacts on odontocetes and pinnipeds could result from the presence of structures. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of the Proposed Action when compared to the No Action Alternative would be **minor to moderate** for mysticetes (except for NARW), odontocetes, and pinnipeds, and **minor** for NARW. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate** for mysticetes (except for NARW), odontocetes, and pinnipeds, and **major** for NARW, and would also include **minor beneficial** impacts on odontocetes and	mysticetes, odontocetes, and pinnipeds *Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level, including the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of Alternative C would be the same as the Proposed Action. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	mysticetes, odontocetes, and pinnipeds *Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level, including the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of Alternative D would be the same as the Proposed Action. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level, including the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. The incremental impact of Alternative E would be the same as the Proposed Action. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	mysticetes, odontocetes, and pinnipeds *Alternative F:* Alternative F1 would not result in measurably different impacts, inclusive of the baseline, from the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW, and could include **minor beneficial** impacts on odontocetes and pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species. Alternatives F2 and F3 would result in measurably different impacts from the Proposed Action due to the avoidance of impact pile-driving noise. However, given the baseline, Alternatives F2 and F3 would still result in **moderate** adverse impacts on pinnipeds, odontocetes, and mysticetes (except for NARW) and **major adverse** impacts on NARW and could include **minor beneficial** impacts on odontocetes and pinnipeds. The incremental impact of Alternative F would be the same as the Proposed Action. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when	mysticetes, odontocetes, and pinnipeds *Preferred Alternative*: This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level, inclusive of the baseline, would be the same as for the Proposed Action: **moderate adverse** impacts on mysticetes (except for NARW), odontocetes, and pinnipeds, and **major adverse** impacts on NARW and could include **minor beneficial** impacts on odontocetes and pinnipeds. The incremental impact of the Preferred Alternative would be the same as the Proposed Action. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
		pinnipeds. These beneficial effects have the potential to be offset by risk of entanglement from derelict fishing gear and/or reduced feeding potential (prey concentrations) for some marine mammal species.				combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	
3.5.7 Sea Turtles	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** impacts on sea turtles. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts on sea turtles and could include **minor beneficial** impacts. Adverse impacts would result mainly from pile-driving noise, presence of structures, and vessel traffic. Beneficial impacts could result from the presence of structures allowing for increased foraging opportunities.	*Proposed Action:* The Proposed Action would result in **minor adverse** impacts on sea turtles, primarily due to pile-driving noise, vessel noise, and presence of structures. **Minor beneficial** impacts could result from the presence of structures allowing for increased foraging opportunities. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **minor adverse** and would also include **minor beneficial** impacts.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* Alternative F1 would not result in measurably different impacts from the Proposed Action: **minor adverse** impacts, with some **minor beneficial** impacts. Alternatives F2 and F3 would result in measurably different impacts from the Proposed Action due to the avoidance of impacts associated with pile-driving noise. However, given that impacts are still expected due to vessel noise, displacement of sea turtles into higher-risk areas associated with the presence of structures, and vessel traffic, construction and installation, O&M, and decommissioning of Alternatives F2 and F3 would still result in **minor** adverse impacts on sea turtles and could include **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** impacts with some **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
3.5.8 Wetlands	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on wetlands, primarily driven by land disturbance. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts, primarily driven by land disturbance.	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on wetlands, primarily due to land disturbance. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate,** primarily due to cable emplacement and onshore construction activities.	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for wetlands. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative could have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.1 Commercial Fisheries and For-Hire Recreational Fishing	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **major adverse** impacts on commercial fisheries and for-hire recreational fishing. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **major adverse** impacts on commercial fisheries and for-hire recreational fishing. These impacts would primarily result from fisheries use and management and the increased presence of offshore structures. The impacts could also include **minor beneficial** impacts for some for-hire recreational fishing operations due to the	*Proposed Action:* The Proposed Action would result in **major adverse** impacts on commercial fisheries and for-hire recreational fisheries, primarily due to fisheries use and management and long-term impacts from the presence of structures, including navigational hazards, gear loss and damage, and space use conflicts. **Minor beneficial** impacts could result from the presence of structures and the artificial reef effect. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **major adverse** and would also include **minor**	*Alternative C:* This alternative would have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* Alternative F2 (suction bucket foundations) would result in the greatest area of habitat conversion from scour protection and was evaluated under the Proposed Action. Alternative F1 (piled foundations) and Alternative F3 (gravity-based foundations) would result in a reduction in scour protection compared to the Proposed Action. However, the overall impact levels under Alternatives F1, F2, and F3 would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action and would modify the layout of offshore structures. However, the overall impact levels would be the same as for the Proposed Action: **major adverse** for commercial fisheries and for-hire recreational fisheries, with the potential for **minor beneficial** impacts on for-hire recreational fisheries. *Cumulative Impacts of Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	presence of structures and the artificial reef effect.	**beneficial** impacts on for-hire recreational fisheries.				combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	
3.6.2 Cultural Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on cultural resources, primarily through the presence of structures. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **major adverse** impacts on cultural resources.	*Proposed Action:* The Proposed Action would result in **major adverse** impacts on cultural resources because a notable and measurable impact requiring mitigation is anticipated. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **major adverse**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the reduction in impact severity on cultural resources would not avoid visual adverse effects as compared to the Proposed Action, resulting in the same overall impact level as the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* The severity of impacts on cultural resources increases with the size of the foundation type and anticipated seabed disturbance. However, the nature of physical activities proposed under this alternative would result in the same level of impacts as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative*: This alternative would include at least 5 fewer WTGs, in addition to a WTG height restriction in Project 1, compared to the Proposed Action and would modify the layout of offshore structures. This would lessen the overall severity of physical and visual impacts on a limited proportion of identified cultural resources; however, the impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Preferred Alternative*: Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.3 Demographics, Employment, and Economics	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** and **minor beneficial** impacts on demographics, employment, and economics, primarily driven by land disturbance and additional employment opportunities.	*Proposed Action:* The Proposed Action would result in **minor adverse** and **minor beneficial** impacts on demographics, employment, and economics, primarily due to job and revenue creation. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for demographics, employment, and economics. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts.	*Preferred Alternative:* This alternative would include at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	Cumulative Impacts of the No Action Alternative: The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** and **moderate beneficial** impacts, the latter of which would be on ocean-based employment and economics.	activities, including the connected action and other offshore wind activities, would be **minor adverse** and **moderate beneficial**. The beneficial impacts would primarily be associated with the investment in offshore wind, job creation and workforce development, income and tax revenue, and infrastructure improvements, while the adverse impacts would result from aviation hazard lighting on WTGs, new cable emplacement and maintenance, the presence of structures, vessel traffic and collisions/allisions during construction, and land disturbance.	*Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.4 Environmental Justice	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** impacts on environmental justice populations, primarily driven by ongoing population growth and new development. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate adverse** impacts, primarily due to short-term impacts from cable emplacement, construction-phase noise, and vessel traffic, as well as the long-term presence of structures. **Minor beneficial** impacts could result through	*Proposed Action:* The Proposed Action would result in **moderate adverse** impacts on environmental justice populations, primarily due to land disturbance, and noise. The Proposed Action would result in **minor beneficial** impacts on environmental justice populations, primarily due to port utilization and presence of structures. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **moderate adverse** impacts and **moderate beneficial** impacts. The adverse effects are primarily driven by land disturbance, and noise and the beneficial	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for environmental justice populations. Thus, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **moderate adverse** and **minor beneficial**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	economic activity, job opportunities, and reductions in air emissions.	impacts are primarily driven by port utilization, presence of structures, and air emissions.					
3.6.5 Land Use and Coastal Infrastructure	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** and **minor beneficial** impacts on land use and coastal infrastructure. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts, primarily driven by land disturbance, noise, and traffic. **Major beneficial** impacts would result from productive use of ports and related infrastructure for offshore wind activity.	*Proposed Action:* The Proposed Action would result in **minor adverse** and **moderate beneficial** impacts on land use and coastal infrastructure. Adverse impacts are primarily due to land disturbance, noise, and traffic during onshore construction. Beneficial impacts are primarily due to supporting designated uses and infrastructure improvements at ports. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **minor adverse** and **major beneficial**. The adverse impacts would primarily be driven by land disturbance, noise, and traffic. The beneficial impacts would primarily be associated with port utilization.	*Alternative C:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would differ only in terms of the offshore components, which would be outside of the geographic analysis area for land use and coastal infrastructure. Thus, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **moderate beneficial** impacts. *Cumulative Impacts of the Preferred Alternative:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.
3.6.6 Navigation and Vessel Traffic	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **moderate adverse** impacts on navigation and vessel traffic. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities	*Proposed Action:* The Proposed Action would result in **major adverse** impacts on navigation and vessel traffic, primarily due to changes in navigation routes, delays in ports, degraded communication and radar signals, and increased difficulty of offshore search and rescue or surveillance missions.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing	*Alternative E:* This alternative would involve a 0.81-nautical mile (1,500-meter) to 1.08-nautical mile (2,000-meter) setback between WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) and the Atlantic Shores South Lease Area (OCS-A 0499). This alternative would result in the exclusion or micrositing of up to 5 WTGs. The setback would be an improvement to vessel navigation and search	*Alternative F:* This alternative would involve installing a range of foundation types, which has little to no impact on navigation and traffic. Furthermore, the number of structures within the OCS would not change under this alternative. Thus, the overall impact level would be the same as for the Proposed Action: **major adverse**.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action and would modify the layout of offshore structures. This modification would lessen potential impacts to vessel navigation. Thus, the overall impact level would be reduced when compared to the Proposed Action: **moderate adverse**.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	(including other offshore wind activities) would result in **moderate adverse** impacts primarily due to the presence of offshore wind structures, which would increase the risk of collisions, allisions, and accidental releases, as well as due to port utilization and vessel traffic.	*Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **major adverse**, primarily due to the increased possibility for marine accidents.	and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	and rescue considerations, but due to the presence of off-grid structures, the impact level would remain the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be reduced from the Proposed Action: **moderate**.
3.6.7 Other Uses (Marine Minerals, Military Use, Aviation, and Scientific Research and Surveys)	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** impacts for military and national security uses except USCG SAR operations, aviation and air traffic, cables and pipelines, and radar systems; **minor adverse** impacts for marine mineral extraction and USCG SAR operations, and **moderate adverse** impacts for scientific research and surveys. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts for marine mineral extraction, military and national security uses except for USCG SAR operations, aviation and air traffic, cables and pipelines and radar systems; and **moderate adverse** impacts for USCG SAR operations and	*Proposed Action:* The Proposed Action would result in **minor adverse** impacts for marine mineral extraction, military and national security uses except for USCG SAR operations, aviation and air traffic, and cables and pipelines; **moderate adverse** impacts for radar systems; and **major adverse** impacts for USCG SAR operations and scientific research and surveys. The presence of structures associated with the Proposed Action and increased risk of allisions are the primary drivers for impacts on USCG SAR operations. Impacts on scientific research and surveys would qualify as major because entities conducting surveys and scientific research would have to make significant investments to change methodologies to account for unsampleable areas, with potential long-term and irreversible impacts on fisheries and protected-	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level for the individual IPFs would be the same as for the Proposed Action and range from: **minor to major adverse**. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* This alternative could have up to 31 fewer WTGs compared to the Proposed Action. However, the overall impact level for the individual IPFs would be the same as for the Proposed Action and range from **minor to major adverse**. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative E:* This alternative would involve a 0.81-nautical mile (1,500-meter) to 1.08-nautical mile (2,000-meter) setback between WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) and the Atlantic Shores South Lease Area (OCS-A 0499). This alternative would result in the exclusion or micrositing of up to 5 WTGs. The overall impacts would be the same as for the Proposed Action except for USCG SAR operations. The setback would be an improvement to vessel navigation and SAR considerations and would lead to reduced impacts for USCG SAR operations when compared to the Proposed Action: **moderate adverse**. The overall impact range would remain **minor to major adverse**. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would	*Alternative F:* This alternative would involve installing a range of foundation types, which has little to no impact on navigation and traffic. Furthermore, the number of structures within the OCS would not change under this alternative. Thus, the overall impact level would be the same as for the Proposed Action and range from: **minor to major adverse**. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action and would modify the layout of offshore structures. The overall impacts would be the same as for the Proposed Action except for USCG SAR operations. The modified layout would be an improvement to vessel navigation and SAR considerations and would lead to reduced impacts for USCG SAR operations when compared to the Proposed Action: **moderate adverse**. The overall impact range would remain **minor to major adverse**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	major adverse scientific research and surveys.	species research as a whole, as well as on the commercial fisheries community. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be **minor adverse** for marine mineral extraction, military and national security uses except for USCG SAR operations, aviation and air traffic, and cables and pipelines; **moderate adverse** for radar systems; and **major adverse** for USCG SAR operations and scientific research and surveys.			the same as for the Proposed Action except for USCG SAR operations, which would be **moderate adverse**. The overall impact range would remain **minor to major**.		Action except for USCG SAR operations, which would be **moderate adverse**. The overall impact range would be **minor to major adverse.**
3.6.8 Recreation and Tourism	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **minor adverse** impacts on recreation and tourism. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **minor adverse** impacts, primarily driven by land disturbance, cable emplacement and maintenance, noise, traffic, anchoring, lighting, and the presence of structures. **Minor beneficial** impacts would result from the anticipated artificial reef effect resulting	*Proposed Action:* The Proposed Action would result in **minor adverse** and **minor beneficial** impacts on recreation and tourism. Adverse impacts are primarily due to anchoring, land disturbance, lighting, cable emplacement and maintenance, noise, traffic, and the presence of structures. Beneficial impacts are primarily due to the presence of structures and the potential for the artificial reef effect. *Cumulative Impacts of the Proposed Action:* Impacts of the Proposed Action when combined with the impacts from ongoing and planned activities, including the connected action and other offshore wind activities,	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* Alternative D1 would exclude placement of WTGs up to 12 miles (19.3 kilometers) from shore, resulting in the removal of up to 21 WTGs. Alternative D2 would exclude placement of WTGs up to 12.75 miles (20.5 kilometers) from shore, resulting in the removal of up to 31 WTGs. Alternative D3 would exclude placement of WTGs up to 10.8 miles (17.4 kilometers) from shore, resulting in the removal of up to six WTGs. Alternatives D1 and D2 may substantially reduce the visual impacts on historic aboveground resources. Alternative D3 is not anticipated to result in a substantial reduction. Though the visual impact may be reduced for Alternatives D1 and D2, the overall impact	*Alternative E: Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would involve installing a range of foundation types, which would not have measurable impacts on recreation and tourism that are materially different from the impacts of the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative:* This alternative would have at least 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor adverse** and **minor beneficial**. *Cumulative Impacts of the Preferred Alternative:* Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
	from installation of offshore structures.	would be **minor adverse** and **minor beneficial**.		level for Alternative D would be the same as for the Proposed Action: **minor adverse** and **minor beneficial** impacts. *Cumulative Impacts of Alternative D:* Impacts of Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.			
3.6.9 Scenic and Visual Resources	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **major adverse** impacts on scenic and visual resources. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **major adverse** impacts due to the addition of new structures, nighttime lighting, onshore construction, and increased vessel traffic.	*Proposed Action:* Effects of Offshore Project elements on high- and moderate-sensitivity seascape character units, open ocean character units, and landscape character units would be **major adverse**. Onshore facilities would result in **major adverse** impacts on scenic and visual resources. *Cumulative Impacts of the Proposed Action:* Overall, impacts from ongoing and planned activities, including other offshore wind activities, would be **major adverse**.	*Alternative C:* This alternative could have up to 29 fewer WTGs and 1 fewer OSS compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative C:* Impacts of Alternative C when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative D:* Alternative D1 would exclude placement of WTGs up to 12 miles (19.3 kilometers) from shore, resulting in the removal of up to 21 WTGs. Alternative D2 would exclude placement of WTGs up to 12.75 miles (20.5 kilometers) from shore, resulting in the removal of up to 31 WTGs. Alternative D3 would exclude placement of WTGs up to 10.8 miles (17.4 kilometers) from shore, resulting in the removal of up to 6 WTGs. Alternatives D1 and D2 may substantially reduce the visual impacts on historic aboveground resources. Alternative D3 is not anticipated to result in a substantial reduction. Though the visual impact may be reduced for Alternatives D1 and D2, the overall impact level for Alternative D would be the same as for the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative D:* Impacts of	*Alternative E: Alternative E:* This alternative could have up to 5 fewer WTGs compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative E:* Impacts of Alternative E when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Alternative F:* This alternative would involve installing a range of foundation types, which would not have measurable impacts on scenic and visual resources that are materially different from the impacts of the Proposed Action: **major adverse** impacts. *Cumulative Impacts of Alternative F:* Impacts of Alternative F when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.	*Preferred Alternative*: This alternative would include at least 5 fewer WTGs, in addition to a WTG height restriction in Project 1, compared to the Proposed Action and would modify the layout of offshore structures. This would lessen the overall severity of visual impacts; however, the impact level would remain the same as for the Proposed Action: **major adverse**. *Cumulative Impacts of Preferred Alternative*: Impacts of the Preferred Alternative when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.

Resource	Alternative A No Action	Alternative B Proposed Action	Alternative C Habitat Impact Minimization/ Fisheries Habitat Impact Minimization	Alternative D No Surface Occupancy at Select Locations to Reduce Visual Impacts	Alternative E Wind Turbine Layout Modification to Establish a Setback between Atlantic Shores South and Ocean Wind 1	Alternative F Foundation Structures	Preferred Alternative
				Alternative D when combined with impacts from ongoing and planned activities, including the connected action and other offshore wind activities, would be the same as for the Proposed Action.			

Common Name	Scientific Name	ESA/ MMPA Status[1]	Relative Occurrence in the Project Area[2, 3]	Seasonal Occurrence in the Project Area
Harbor seal	*Phoca vitulina*	None/N	Regular	Year-round, peak fall-spring
Harp seal	*Cystophora cristata*	None/N	Rare	Rare
Hooded seal	*Phoca groenlandica*	None/N	Rare	Rare
Sirenians				
West Indian manatee	*Trichechus manatus*	T/D	Rare	Rare

[1] E = endangered; T = threatened; D = depleted; N = non-strategic.
[2] Rare – limited sightings for some years; uncommon – occurring in low numbers or on an irregular basis; regular – occurring in low to moderate numbers on a regular basis or seasonally; common – occurring consistently in moderate to large numbers.
[3] Source: COP Volume II Section 4.7.1.1, Table 4.7-1; Atlantic Shores 2024.

For the purposes of the description of the affected environment in this Final EIS, the focus is on 16 species of marine mammals (comprising 17 stocks) that would be likely to occur in the Offshore Project area or experience acoustic effects of the Proposed Action. This includes four ESA-listed whale species (i.e., NARW, sperm whale, sei whale, fin whale), two non-ESA listed whale species (i.e., minke whale [*Balaenoptera acutorostrata*], humpback whale [*Megaptera novaeangliae*]), several types of delphinids and small whales (i.e., Atlantic spotted dolphin [*Stenella frontalis*], Atlantic white-sided dolphin [*Lagenorhynchus acutus*], bottlenose dolphin [*Tursiops truncatus*, comprising two stocks, the Western North Atlantic Offshore and the Northern Migratory Coastal], common dolphin [*Delphinus delphis*], long-finned and short-finned pilot whales [*Globicephala* spp.], Risso's dolphin [*Grampus griseus*], and harbor porpoise [*Phocoena phocoena*]), and two pinniped species (i.e., harbor seal [*Halichoerus grypus*], gray seal [*Phoca vitulina*]). These species are analyzed herein. Marine mammal species likely to occur in the Project area or experience acoustic effects of the Proposed Action are described in the following paragraphs. The most recent Duke University Marine Geospatial Ecology Lab density models (Roberts et al. 2016b, 2023) were used to create activity-specific densities for each activity under the Proposed Action. Population information for marine mammals likely to occur in the Project area or experience acoustic effects of the Proposed Action is provided in Table 3.5.6-2. Other marine mammal species are not described further in this subsection but are included in the impact assessments below.

Threatened and Endangered Marine Mammals

The ESA (16 USC 1531 et seq.) classifies certain species as threatened or endangered based on their overall population status and health. Four marine mammals that are likely to occur in the Project area or are expected to experience acoustic effects are classified as endangered: fin whale, NARW, sei whale, and sperm whale. Of the marine mammal species listed under the ESA, critical habitat has only been designated for the NARW (NMFS 2016b), as described below. The BA for Atlantic Shores South (BOEM 2023a) provides a detailed discussion of ESA-listed species and critical habitat and potential impacts on these species and habitats as a result of the Project. The BA submitted to NMFS found that the Proposed Action *may affect, is likely to adversely affect* some ESA-listed marine mammal species (i.e., fin whale, NARW, sei whale, and sperm whale) but is expected to have no effect on critical habitat designated for NARW (BOEM 2023a). Consultation with NMFS pursuant to Section 7 of the ESA was completed December 18, 2023, per the completed Biological Opinion available online at https://www.fisheries.noaa.gov/s3/2024-02/GARFO-2023-01804.pdf. NMFS concluded that the Proposed Action is likely to adversely affect but is not likely to jeopardize the continued existence of fin whales, NARWs, sei whales, or sperm whales. Additionally, per the completed Biological Opinion, the Proposed Action is not likely to adversely affect blue whales or Rice's whale and is expected to have no effect on critical habitat designated for NARW (NMFS 2023a).

Table 3.5.6-2. Population information for marine mammals likely to occur in the Project area or experience acoustic effects of the Project

Common name	Stock	Population Estimate	Annual Human-Caused M/SI[1]	Reference
Fin whale	Western North Atlantic	6,802	2.05	NMFS 2024d
Humpback whale	Gulf of Maine	1,396	12.15	Hayes et al. 2020
Minke whale	Canadian East Coast	21,968	9.4	NMFS 2024d
North Atlantic right whale	Western North Atlantic	340	27.2	NMFS 2024d
Sei whale	Nova Scotia	3,292	0.6	NMFS 2024d
Atlantic spotted dolphin	Western North Atlantic	31,506	0	NMFS 2024d
Atlantic white-sided dolphin	Western North Atlantic	93,233	28	NMFS 2024d
Bottlenose dolphin	Western North Atlantic – Offshore	64,587	28	NMFS 2024d
	Western North Atlantic – Northern Coastal Migratory	6,639	12.2–21.5	Hayes et al. 2021
Common dolphin	Western North Atlantic	93,100	414	NMFS 2024d
Harbor porpoise	Gulf of Maine/Bay of Fundy	85,765	145	NMFS 2024d
Long-finned pilot whale	Western North Atlantic	39,215	5.7	NMFS 2024d
Risso's dolphin	Western North Atlantic	44,067	18	NMFS 2024d
Short-finned pilot whale	Western North Atlantic	18,726	218	NMFS 2024d
Sperm whale	North Atlantic	5,895	0	NMFS 2024d
Gray seal	Western North Atlantic	27,911 (U.S. waters)	4,570	NMFS 2024d
Harbor seal	Western North Atlantic	61,336 (U.S. waters)	339	Hayes et al. 2022

[1] Annual human-caused M/SI (mortality and/or serious injury) is mean annual figure for the period 2017–2021, with the exception of humpback whale, the Western North Atlantic – Northern Coastal Migratory stock of bottlenose dolphin, and harbor seal.

Fin whale: Fin whales found in the Offshore Project area belong to the Western North Atlantic stock. This species inhabits deep offshore waters of every major ocean and is most common in temperate to polar latitudes (NMFS 2021c). In the U.S. Atlantic, fin whales are common in shelf waters north of Cape Hatteras, North Carolina, and are found in this region year-round (Edwards et al. 2015; Hayes et al. 2020). This species most commonly occupies waters along the 328-foot (100-meter) isobath but may be found in both shallower and deeper waters (Kenney and Winn 1986). Primary prey species for fin whales

Attachment 17:

March 29, 2023 Email Containing Atlantic Shores March 7, 2023 Modeling Memo (Content in Black Italics) and EPA Responses

Subject: **Atlantic Shores Offshore Wind, 1-hour NO2 modeling**
Date: **March 29, 2023**

AJ and others,

Please find our subsequent responses to your March 7, 2023 memo/email in blue.

Atlantic Shores Off-Shore Wind (ASOW) provided an approach to modeling 1-hour Nitrogen Dioxide (NO_2) in an email to the Environmental Protection Agency (EPA) Region 2 dated February 21st, 2023. An initial response from EPA Region 2 was received on February 24th, 2023. This letter contains the initial approach summarized below in boxes. The EPA comments on the initial approach are in red below, and ASOW's responses appear in *italics.*

In this email, EPA is providing subsequent responses in blue. These were discussed with you on March 9, 2023. On March 22, 2023 you also sent us a follow up email where you further proposed to include all construction emissions in one year with a possible spillover of the construction emission activities into the second year. Our subsequent responses are below (on March 29, 2023). Please note that this discussion is limited to the 1-hour NO2 NAAQS analysis. Let us know if you have any further questions. We are available for additional discussions.

1. Run AERMOD with 3-years of meteorological data with each of the heavy-emitting activities located adjacent to one another at a single location in the Wind Turbine Area (WTA). This will be used to identify the worst-case meteorological year.

No comment was received from EPA. No comment on this box per se. Depends on the rest of the context.

2. Prepare an hourly emission file for the heavy-emitting activities in the WTA, using the same source layout in Step 1. The hourly emission file will:

Will this include other nearby WTG and/or OSS construction activities that could reasonably occur simultaneously.

Yes.

Please clarify that the emissions from an individual source does not vary on an hourly basis. The emissions must be the maximum allowable which is a fixed rate. Please confirm or clarify.

The emissions would not vary on an hourly basis, and would be the full emission rate shown in the calculations provided in the September 1, 2022 application, which is a fixed rate when the source is operating.

Regarding the term "maximum allowable" we call your attention to the executive summary of our September 1, 2022 application, which states:

"Vessel data will remain highly speculative throughout the permitting of the Projects. Vessel selection will not be refined until much closer to the start of construction, and vessels may be changed out even after construction begins. Therefore, this application uses currently best-available information on representative vessel types, with typical or fleet-average emission rates. The number, type, size, and emission rates of vessels could be higher or lower than modeled for any individual activity. Overall, the use of the maximum design scenario associated with the Projects' PDE will serve to ensure a reasonably conservative estimate of emission rates and impacts from the Projects."

The term "full emission rate" is unclear. Please keep in mind that the modeled emission rate will be considered for inclusion into the permit. In the October 28, 2022 letter responding to EPA's comments, it was indicated that the **maximum hourly emissions** were available and would be used (in addition to the intermittent emission averaging which EPA did not agree with as a blanketed assumption.) Maximum emission rates must be input to the model.

Excerpt from October 28, 2022 letter that responded to EPA's September 30, 2022 comments on the September 1, 2022 air permit application:

EPA comment 2. Please clarify whether emission rates used for the short-term NAAQS and increment represent October 28, 2022As mentioned in the July 1, 2022 modeling protocol comments, the use of the March 1, 2011 EPA guidance on "intermittent" emissions may have been misinterpreted here. While the location of the emissions varies, they are continuous over the construction period and may impact the same receptor at varying degrees on different days. Therefore, these are not "intermittent" with respect to the March 1, 2011 Guidance.

AS Response: We believe this comment may stem from differences in terminology. The modeling uses emissions that are continuous over the worst-case construction year and addresses the fact that the location of the emissions varies by using the **maximum hourly emissions**, scaled by the number of hours that the source is at the location divided by 8,760 hours, at each individual location.

We understand that there is uncertainty in the emissions and available vessels in practice, but since there is uncertainty the modeling of public health standards must be based on the maximum emission scenario and per Table 8-2 of the Guideline on Air Quality Models (40 CFR Part 51, Appendix W). Permit limits will be developed around these emission rates/assumptions. If more refined information becomes available, we can revisit the analysis.

a. Utilize the maximum hourly emission rate for each heavy-emitting activity during the peak year of impact identified in Step 1.

Only the heavy emitting activities?

Yes, Heavy emitting activities include:

- *Off-shore substation installation*
- *Wind turbine generator (WTG) Foundation installation*
- *WTG Installation*
- *Scour Protection*
- *Pre-lay Grapnel*
- *Inter-array Cable Installation*
-

This is a good list, however, does the offshore substation installation include both the installation of both the topside and the foundation of the OSS? Both should be included in the cluster in order to be consistent with other proposed wind farms.

As shown in our September 1, 2022 application, commissioning activities have lower emissions and lower impacts. Commissioning activities take place over longer periods and cannot take place at the same time/location as construction activities. We'd like to discuss the logistics of modeling a representative 3-year period that includes heavy construction activities in year 1, commissioning in year 2, and O&M in year 3. Given the complexities of offshore construction it is impossible to know whether this (or any) arrangement truly captures every possible worst-case combination of activities, but we believe it would address all proposed emissions in a reasonably conservative worst-case scenario.

As discussed during our March 9, 2023 meeting, when prognostic meteorological data is used, EPA's Guideline on Air Quality Models requires 3 years of the data in order to capture the temporal representativeness of the year to-year variations in weather conditions. This does not mean that the emissions occur for 3 years, but 3 years represents a climatological period for modeling purposes. This is the case even for short term impacts which can occur on any given day when the activity would happen.

As we also discussed on the March 9, 2023 meeting, we do not agree that modeling year 1 as construction, year 2 as commissioning, and year 3 as OM (and further including the incorporation of intermittent emissions) is appropriate. EPA recognizes that in the case of nearfield OCS construction modeling, the construction emissions vary spatially across the wind development area and are not permanent. In your case, you estimate that construction will take about 2 years.

Notwithstanding this, we understand that the nature of the construction has a spatial and temporal element since the construction lasts only for approximately 2 years. In essence, an ambient monitor would measure concentrations from this construction on only 2 years and with the 3rd measuring concentrations from operation and maintenance. Therefore, we believe that a more technically defensible approach along your lines is to determine the 2 worst-case meteorological years and model the clustered construction emissions with those full 2 years. The third year could be the emissions from the operation and maintenance (but not across the board as intermittent). All three years would be used to calculate the 3-year average of the 98th percentiles of the daily hourly maximum NO_2 concentrations at each receptor. This procedure would only be acceptable for the construction phase given that it is not the permanent OCS source. However, for the record, since the operation and maintenance phase is the permanent source, it requires a separate analysis of its emissions across the 3 years of meteorology to ensure compliance with the NAAQS. These emission limits would be considered in drafting the OM phase of the OCS permit.

b. For emissions associated with heavy-emitting activities that operate less than a full day at a location, vary emissions hourly. For example, if a source operates for only 10 hours in a given day, the hourly emissions file will have that source on for 10 hours each day during the peak year, and off for the remaining 14 hours.

A full day is required since the 1-hour NO2 NAAQS is the maximum hourly impact in a day. Shorter than a day maybe considered if permit limits are placed to confine the construction activity during certain times of day, i.e. only between 7am and 7pm.

We have concerns that modeling certain activities as if they operated 24 hours a day could dramatically overstate impacts. We're equally concerned that time-of-day restrictions would be untenable in the face of extremely complex offshore construction logistics. Enforcing time-of-day restrictions is likely to increase actual air emissions, because vessels must run their engines while waiting to work, and could significantly increase actual air emissions if delays cause chain reaction impacts to the schedule.

Consider pile driving of wind turbine foundations as an example. It is impossible for pile driving to occur for 24 continuous hours. Atlantic Shores expects a single wind turbine foundation pile driving installation activity to require only a limited number of hours (likely 3-6 hours of piling) followed by several hours of less-intensive TP installation and finishing works. The entire activity is estimated to require fewer than 12 hours of activity per day in a single WTG location before moving to another WTG location.

As another example, activities associated with cable-laying involve different vessels working along the same route. In a single day, a single location could have a sand wave clearance vessel, followed by a vessel performing the pre-lay grapnel run, followed by a cable installation vessel. (Operational descriptions were provided in Section 1.2.5 of the September 1, 2022 application). These vessels cannot possibly operate in close proximity to one another and would never be emitting at the same place at the same time.

We believe our proposal to model based on the planned daily operational schedule is appropriate to address a reasonably conservative worst-case scenario.

Footnote 2 of Table 8-2 of the Guideline on Air Quality Models prohibits the averaging across non-operating hours. The same footnote does allow excluding certain hours if there is a permit condition that restricts the emissions from occuring during those hours (i.e., using the EMISFACT keyword). You have previously mentioned that you do not want such permit limits since you do not know which hours the emission would occur in a day. One possible approach is to run the model on a rolling 24-hour period for the blocks that it takes to accomplish the activity. This would ensure that all meteorological conditions are assessed. We further note that this should only be done for certain vessels that are not physically present at the activity site represented in your cluster for the full 24-hour period.

c. During the other two years, the construction activities will have an hourly emission rate of 0 grams per second because construction will happen only once.

Since the 1-hour NO_2 NAAQS is a 3-year average (in this case due to 3 years of met data), how is the contribution of nearby activities on different years accounted for in the averaging if they are zero? Does the scenario assume that all construction emissions will occur in one year? Perhaps this could be clarified and we will check with OAQPS to obtained concurrence.

Construction is expected to occur over an approximately 2-year period. The proposed analysis clusters the highest emitting activities adjacent to one another in a situation that is highly unrealistic to account for concerns related to impacts from overlapping activities.

Below is a table showing the estimated actual days of a construction at a single position for each heavy emitting activity versus the length of time it's being represented in the proposed modeling for 1-hour NO_2. The clustering of all these activities in a single year will mean that it would be impossible for the activities to also be occurring in subsequent years. Lower-emitting activities, either commissioning or O&M, could occur in other years.

Table 1
Days of Actual Construction versus Proposed Modeled Days of Construction

Heavy Emitting Activity	Days of Actual Construction at a Single Position	Proposed Modeled Days at a Single Position
Foundation Installation (B02)	1.5 days	365 days (possibly avoiding Time-of-Year restrictions)
WTG Installation	2.6 days	365 days
Pre-lay Cable Preparation	< 1 day	365 days
Inter-array Cable Installation	1.1 days	365 days
OSS Installation	5 Days	365 days (possibly avoiding Time-of-Year restrictions)
Scour Protection	0.5 Days	365 days

It is our understanding that AS has moved away from the use of zero emissions as discussed in box c above. Please confirm. However, for clarity we would like to comment that Table 1 above lists the days it takes to construct a single WTG or OSS. The modeling method you are proposing represents a cluster of emissions that could occur on any given day. Since there are up to 200 WTC and 10 OSS locations, the impacts repeat themselves at different locations over the course of the approximate 2 year construction period. Compliance with annual average NAAQS and increments would take into account the annual emission rate.

d. During the other two years, incorporate into the modeling emissions expected from Operations and Maintenance (O&M) in the WTA. These emissions will be modeled as Vineyard Wind modeled them during O&M as intermittent. As indicated in the Environmental Protection Agency's (EPA) January 18th, 2023 letter: In the case of Vineyard Wind an emission source was modeled as intermittent during the Operation and Maintenance Phase. In that case, the emission source indeed operates infrequently and sporadically; it is not a construction phase source with continuous emissions that may affect the NAAQS and increment.

As stated in our January 18, 2023 letter, the used of intermittent emission (or smoothing of emissions) is not acceptable even for O&M. The reference to Vineyard Wind was for an emission source. There was one emission source that used this, not the entire O&M modeling analysis. Further, the intermittent guidance does not apply to the increment since it is a deterministic standard not a probabilistic standard. Please disregard the reference to the increment in that sentence.

The primary vessel involved in O&M is a Service Operations Vessel (SOV). The O&M for the WTGs and OSS consist of inspections and maintenance of mechanical and electrical components, performed using crew transfer vessels (CTVs), service operation vessels (SOVs), and/or helicopters. Other vessels that are involved with O&M would visit the WTGs and OSS even less frequently and more sporadically than the CTVs and SOV. Therefore, given the Vineyard Wind precedence use of the intermittent guidance is appropriate. With regards to the comment concerning the increment, ASOW understands and will disregard the reference concerning the increment above.

EPA has clarified this position several times. Vineyard Wind did not assume intermittent emissions for all sources across the board or without justification on an individual emission source. The use of the intermittent emissions per the March 2011 memo is considered on a case-by-case basis. Using the intermittent guidance without taking into account details of the emission source (such as the frequency or duration) would not be appropriate since it only smooths the emission rates and is not representative of emissions of a short-term scenario from a primary source where measures may be taken to avoid adverse short-term impacts. EPA is willing to consider on a case-by-case basis modeling individual emission sources as intermittent that are not reasonably present on frequent basis during operation and maintenance. This is typically a support emission and not the primary emission. Permit conditions may also be necessary. In the case of Vineyard Wind, for example, there were backup generators. These emission sources were limited to 500 hours per year. During our last call on March 9, 2023, you mentioned using this technique only for the Service Operating Vessel (SOV) since it does not remain at the location for several hours. If you can provide further details on how this would be implemented, we can discuss. The annual period would still need to be modeled.

3. The modeling methodology for 1-hour NO2 proposed above, will utilize the Ozone Limiting Method (OLM) Tier three approach with use of the following parameters:
    a. NO2 Seasonal Hourly File for 2018-2020 using hourly NO2 obtained from Millville, NJ (AQS ID: 34-011-0007). Missing hours will be filled in using the higher of the hour before or hour following the missing data. Data will be broken out into seasons, sorted by hour of day, and then ranked to determine the 98^{th} percentile seasonal hourly background value for each hour. This value would then be input into AERMOD.
    b. The hourly Ozone (O3) file for 2018-2020 will use hourly O3 data from the following sites:

i. Brigantine, Galloway, NJ (AQS ID: 34-001-0006)
ii. Millville, NJ (AQS ID: 34-011-0007)
iii. Ancora State Hospital, in Winslow, NJ (AQS ID: 34-007-1001) [Data from Ancora is only available March to October of each year]
iv. The hourly ozone file will be constructed as follows:
    1. If data was available, would use Brigantine. If data was missing from Brigantine, then the Millville site would be used. If data was unavailable from both the Brigantine and Millville sites, the Ancora site would be used. If data was unavailable for all three sites, data would be filled in using the higher of the hour before or hour following the missing data with data from Brigantine.

c. An in-stack ratio (ISR) of 0.11 is proposed to be used for all sources. This is based on review of the "NO2_ISR_Database.xlsx" for Uncontrolled, reciprocating IC Engines where measured ISR's ranged from 0.062 to 0.099 for engines tested under a variety of loads. The EPA ISR database was obtained from: https://www.epa.gov/sites/production/files/2020-11/no2_isr_database.xlsx

No comment was received from EPA. (Sentence should be black, italics. The OLM proposal in the box is fine with our additional comments below.)

In addition, to the comments above, in we would like to ensure the following:

- That the OLM GROUPALL keyword is used in the input file,
- That the units in the background ozone concentrations are converted to ug/m3 if they are in ppb,
- That the equilibrium ratio is set to 0.9.

These will be incorporated into the OLM analysis.

Should you have any questions about this submittal, please feel free to contact Joe Sabato (774-293-8009 or jsabato@all4inc.com) or AJ Jablonowski (978-793-2571, ajablonowski@epsilonassociates.com).

We trust this email provides further guidance on our ongoing discussions. Please reply by April 5, 2023. Again, we are available for further discussion.

Annamaria Colecchia

Attachment 18:

Article by R. Lacal-Aránteguia *et al.* entitled "Offshore wind installation: Analysing the evidence behind improvements in installation time."

Renewable and Sustainable Energy Reviews 92 (2018) 133–145

Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Offshore wind installation: Analysing the evidence behind improvements in installation time

Roberto Lacal-Arántegui[a,*], José M. Yusta[b], José Antonio Domínguez-Navarro[b]

[a] Joint Research Centre, European Commission, Petten, The Netherlands
[b] Department of Electrical Engineering, Universidad de Zaragoza, Spain

ARTICLE INFO

Keywords:
Offshore wind installation
Learning
Cost-reduction
Foundations
Turbines

ABSTRACT

The most important single event of the last years in wind energy technology is the reduction in the cost of producing wind electricity offshore, a reduction that can reach 75%, depending on the system boundary considered, for installations commissioned by 2024. Surprisingly, there is very little scientific literature showing how this reduction is being achieved.

The objective of this paper is to analyse the evidence behind cost reduction in one of the most significant cost elements of offshore wind farms, the installation of foundations and turbines. This cost is directly dependent on the daily rates of the installation vessels and on the days it takes to install those wind farm elements. Therefore, we collected installation data from 87 wind farms installed from 2000 to 2017, to establish the exact time for installation in each.

The results show that advances have reached 70% reduction in installation times throughout the period for the whole set, turbine plus foundation. Most of these improvements (and the corresponding impact in reducing costs) relate to the larger size of turbines installed nowadays. There is, therefore, not any leap forward in the installation process, but only incremental improvements applied to turbines that are now four times as large as in 2000.

1. Introduction

Wind energy, both onshore and offshore, is one of the key technological options for a shift to a decarbonised energy supply causing, among other benefits, a reduction in fossil fuel use and in greenhouse gas emissions [1].

It is offshore that wind energy has traditionally most been presented as an energy source with a huge unrealised potential. To date, this is because of the complexity of the technology and project management, the harsh marine environment, and the related high cost of installing wind turbines in the seas. However, this is set to change. The technological developments of the last ten years, among other factors, have led to significant cost reductions that have manifested in recent tender and auction prices.

The analysis of the evolution of offshore wind farm installation time is all but absent in the scientific literature. Schwanitz and Wierling [2] briefly discussed construction time as part of their thorough assessment of offshore wind investment, and showed that wind farm offshore construction time has increased from 2001 to 2016, but it has decreased in unit term (years/MW). One of the data issues shown by this research is the very disperse data set giving $R^2 = 0.05$ (see Fig. 4b in [2]), when construction times are "measured as the period between the beginning of (…) offshore construction and the date of commissioning", perhaps a relatively low level of detail. Interestingly, these authors also discuss the impact of water depth in driving installation costs.

Based on Benders decomposition, Ursavas [3] modelled the optimisation of the renting period of the offshore installation vessels and the scheduling of the operations for building the wind farm. This author provides interesting information on the impact of weather on installation, e.g. "for the Borkum West project the installation of a complete top side of the wind turbine generator that MPI achieved was 25 hours yet some wind turbine generators were under construction for over 3 weeks due to weather conditions". This same purpose, the modelling of the optimisation of transport and installation, was the result of the research by Sarker and Ibn Faiz, concluding that "the total cost is significantly impacted by turbine size and pre-assembly method" [4].

Abbreviations: CapEx, capital expenditure; EU, European Union; GW, gigawatt; IEA, International Energy Agency; MP, monopile; MS, megawatt; OWF, offshore wind farm; TIV, turbine installation vessel; TP, transition piece

* Corresponding author.

https://doi.org/10.1016/j.rser.2018.04.044
Received 31 July 2017; Received in revised form 23 March 2018; Accepted 14 April 2018

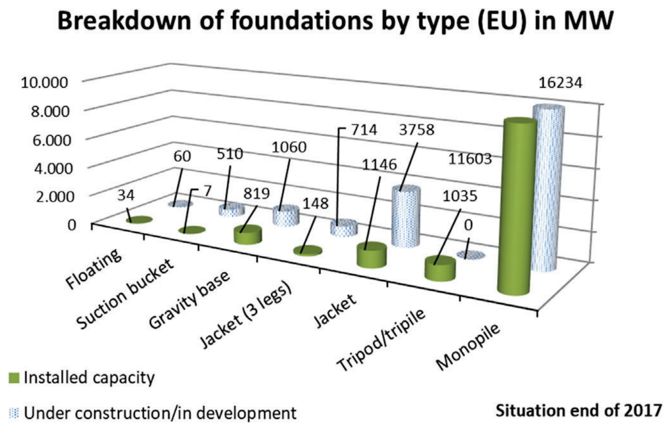


Fig. 4. Breakdown of offshore wind capacity per foundation type, for European OWF, both operational by the end of 2017 and under construction, or in development at the end of 2017 with expected commissioning by 2024. Source: own data. Remarks: 55% of the 22 GW in development have decided the foundation type; for the other 45% it was assumed that monopiles will be used for average depths below 36 m, jackets above 36 m and a few projects will use floating or gravity base foundations.

The domination of monopile foundations is not likely to be challenged in the near future, even when jacket technology is -at the moment- a preferred technology for depths between 36 and 60 m, and suction bucket systems are starting to emerge. Projections to 2024 in Fig. 4 show the decline of tripod and tripile technologies in favour of jackets and monopiles.

OWFs which are not exactly offshore were included in the Fig. 4 but not in the detailed analysis below. These include turbines in inner lakes (e.g. Vanern in Sweden), or physically connected to the coast at the shoreline (e.g. Irene Vorrink in The Netherlands).

Because some of the last OWFs already finished foundation installation there are more foundation than turbine data points, 78 and 74 respectively, excluding floating and non-commercial projects. Of the former, 59 use monopile systems (10 in the 1.5–2.3 MW range, 36 in the 3–4 MW range and 13 above 6 MW), 9 gravity, 3 tripod/tripile, and 6 use jackets.

Fig. 5 shows the overall picture of the evolution of time taken only for the installation of the foundations, in vessel-days per foundation. Three phases can be distinguished: an initial phase until 2008 featuring few installations and very high dispersion, a consolidation phase from 2009 to 2013 when projects became large (up to 175 turbines), significant variation in the type of foundation and higher overall installation time, and the pre-industrialisation from 2014 onwards which shows significant time reductions.

Figures in Table 3[6] show that the set of OWF foundations installed after 2013 took significantly less time to install than the set of foundations corresponding to 2009–2013.

Monopiles installed recently (2014–2017) required only 56% (2.39/4.24) of the installation time needed during the previous period (2009–2013). However, if measured in terms of installation time per megawatt, recent monopiles required only 38% (0.50/1.32) of the time of the previous period.

Comparing figures per megawatt in the recent period shows that the set "all foundations" takes longer to install per MW (0.54 vessel-days) than monopiles (0.50). The difference is minor only because monopile installations outnumbered non-monopile installations 23 to 4 during the period 2014–2017

Fig. 5 shows as well that whereas modern monopile-based

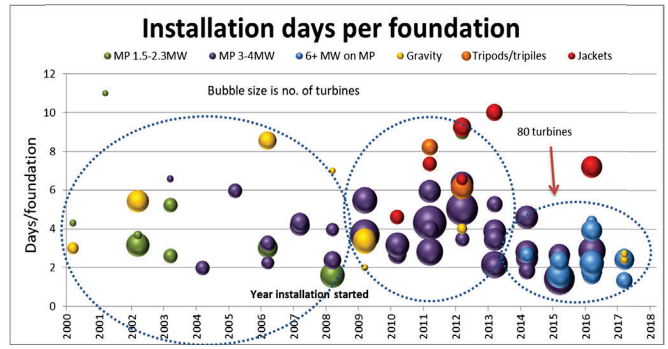


Fig. 5. Overall picture of the time taken to install one foundation (without the turbine) for each OWF that has finished foundations installation. Source: own data.

installations are the fastest foundations to install, two gravity base projects very close to the coast also were object of very efficient installation. However, on average non-monopile projects on average take longer to install.

There is therefore a pre-eminence of monopile foundations in the OWF installed or being installed, resulting in a larger dataset. In addition, there is a trend for monopiles to cover increasingly deeper waters and larger turbines. Thus, it is appropriate to focus the remaining analysis of foundations and turbine-foundation sets on monopile-based installation.

4.2. Does installation time depend on water depth and/or distance from the coast?

Fig. 6 shows that the number of existing OWFs really far from the coast or in waters 30 m or more is small: 4 and 9 respectively, out of 59. The graphs show that most deep-water monopile installations to date took place not far from the coast, up to 45 km.

In theory at least, both deeper waters and distances farther from shore should cause longer installation times. This is because deeper waters would make installation more complex and monopiles are larger and need to be hammered deeper into the subsea; further distances involve longer navigation time for the installation vessels.

However, the data in Fig. 6 tell a very different story: installation time is in general independent from average water depth whereas it only shows a minor positive correlation with distance to shore in the case of the larger turbines. Regarding water depth, it is perhaps significant that the dispersion of installation days with water depth is very high below 25 m but it is much lower beyond this depth. Regarding distance, the two farthest-away data points of the 3–4 MW turbine series shown in Fig. 6 (right) correspond to wind farms with low installation time, 2.7 and 1.43 vessel-days per monopile respectively. The reason is perhaps that both wind farms (Sandbank and Gemini) started installation very recently (2015), when technological advances and organisational learning caused important reductions in installation time.

Conversely, Fig. 6 shows that wind farms with equal or very similar depth/distance have taken very different installation time. For example, OWFs Meerwind and Borkum Riffgrund 1, at 24 and 26 m depth, located 53 and 54 km from shore and with similar distances to the installation ports (92 and 80 km), took 6.4 and 2.5 vessel-days, respectively, to install. Interestingly, they both installed the same turbine model and had similar total capacity, and thus these factors cannot be accounted for the differences. The main difference is likely to relate to vessels and installation methods. In addition, the former started installation in 2012 whereas the latter in 2014.

[6] Table 3 does neither consider floating wind farm Hywind Scotland nor experimental projects Alpha Ventus, Gunfleet Sands III, Belwind Haliade, Nissum Bredning, Blyth Demonstration, and Beatrice pilot.

Table 3
Average installation time in vessel-days of the periods 2009–2013 and 2014–2016. Data include outliers. Source: own calculations.

Non-weighted average installation time of foundations	(Vessel-days) /foundation	(Vessel-days) /MW
Foundations started construction between 2009 and 2013 (all foundations)	5.22	1.39
Foundations started construction between 2014 and 2017 (all foundations)	2.56	0.54
Foundations started construction between 2009 and 2013 (monopiles)	4.24	1.32
Foundations started construction between 2014 and 2017 (monopiles)	2.39	0.50

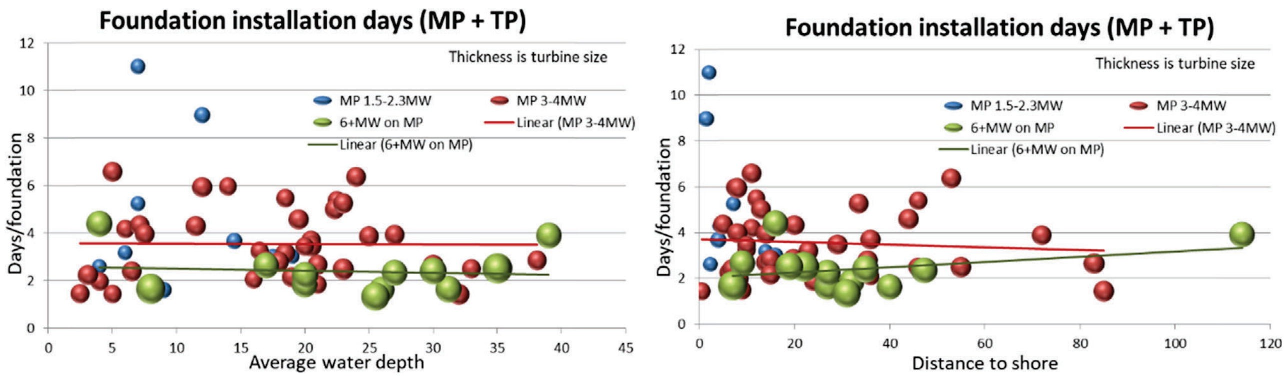


Fig. 6. Relationship between installation time and average water depth and distance to shore. Source: own data, 4COffshore.

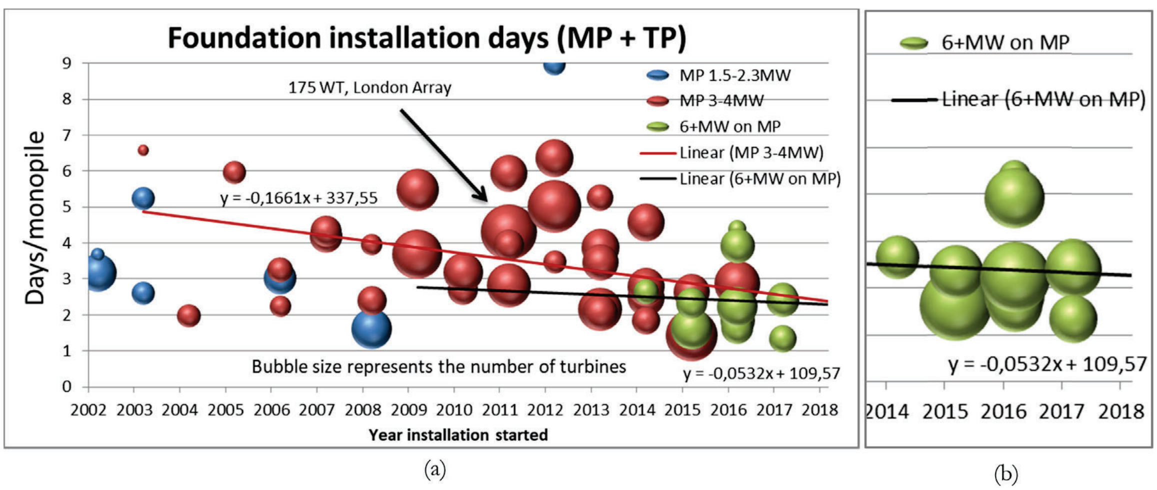


Fig. 7. (a) Evolution of foundation installation days related to wind farm size; (b) enhanced view of the 6 + MW set.

4.3. Economies of scale: relation to wind farm and turbine size

This subsection explores how monopile installation time is related to the wind farm and turbine sizes.

In Fig. 7 the number of turbines is a proxy for wind farm size. The figure shows that there are large wind farms above and below the 3–4 MW trend line. The size of the bubbles (i.e. number of turbines per OWF) does not suggest the existence of economies of scale, as larger wind farms do not take generally less time to install per foundation.

The series of installations with turbines rated 6 MW or above suggest a slightly different situation. Part (b) of Fig. 7 shows that in this group of installations the two largest wind farms (Gode Wind I & II, Race Bank) are, by different margins, more efficient than the weighted average of 2.28 days/monopile. Note that given the higher number of data points, the message conveyed by the 3–4 MW group should be considered more robust.

Given the apparent contradiction, more insight was sought by plotting installation time against the same indicator, the number of turbines, without taking into account the evolution factor (year installation started), for all monopile installations together (Fig. 8).

The data shows that the number of vessel-days reduces only slightly

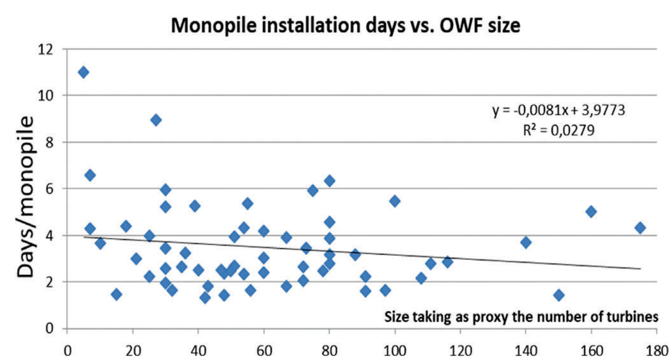


Fig. 8. Relationship between monopile installation time and wind farm size as reflected by the number of foundations.

as the wind farm increases in size. In addition, the R-square factor of 0.0279 shows a level of dispersion such that the results cannot be considered conclusive. Similar analysis but taking the wind farm capacity (in MW) as the proxy for size only improves R-square slightly to 0.0891. This aspect is therefore still not conclusive and by taking both

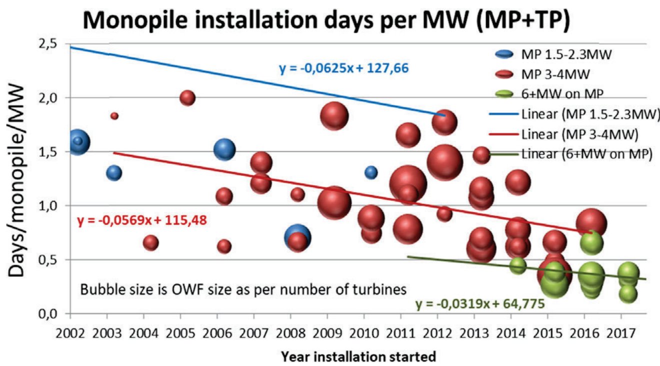


Fig. 9. Monopile installation days per MW terms.

approaches into account we can conclude that there is only a low level of economies of scale with wind farm size.

4.4. Reduction in foundation installation time per megawatt-equivalent

The picture changes significantly if the focus of the analysis is the megawatt-equivalent of monopile installation, as shown in Fig. 9. This unit is better placed to connect with the eventual reduction in the cost of energy.

In effect, the fact that turbine technology has improved and larger turbines are being installed in each foundation is claimed to have had the biggest impact in the reduction of installation days per megawatt. From 1991 up to 2004 essentially only turbines below 2.5 MW were installed on monopiles, whereas after 2006 only turbines in the 3–4 MW range were installed (Fig. 9), with two exceptions. In 2016 for the first time, most wind farms that started installation were designed for turbines larger than 4 MW – in fact as much as 8 MW.

Improvements in foundation installation times per megawatt has thus clearly outpaced improvements per foundation. The reduction in installation time per monopiles from 2000 to 2017 was 58%, as taken from two samples: the non-weighted average of the seven wind farms built between 2000 and 2003 (5.22 days per foundation), and the corresponding one for four wind farms that started to install in 2017 and already finished (2.19 days). Data show that the corresponding figures ***per MW*** of the turbine installed were 2.47 days in 2000–2003 and 0.30 days in 2017, ***an 87% reduction***. One wind farm, Belgian Rentel project, even managed to install monopiles at 0.18 days/MW.

Fig. 9 very vividly proves the large impact that the newer, large turbines have had in reducing installation time per megawatt. Comparing the trend lines for the groups of turbines shows the significant reduction first from the 1.5–2.3 MW to 3–4 MW and recently to the 6 + MW technologies.

4.5. Discussion

Monopile technology dominates the market for offshore wind foundations fixed to the sea floor. Monopiles take, on average, less time to install than any other type of foundation, and more so when measured in terms of days per MW equivalent.

There is no correlation of installation days with water depth nor with distance to shore, but there is a clear trend towards shorter installation time overall. Other variables have a stronger influence, the most important of which could probably be the capabilities of the vessels used and the distance to the construction port instead of the direct distance to the shore.

On average, significant time reductions began to happen after 2013, with monopiles being installed in only 38% of the time (per MW equivalent) as in the period 2009–2013. This was coincidental with entry into service of new, large vessels (140– 160 m long) Pacific Orca, Pacific Osprey, Vidar, Aeolus, Scylla…

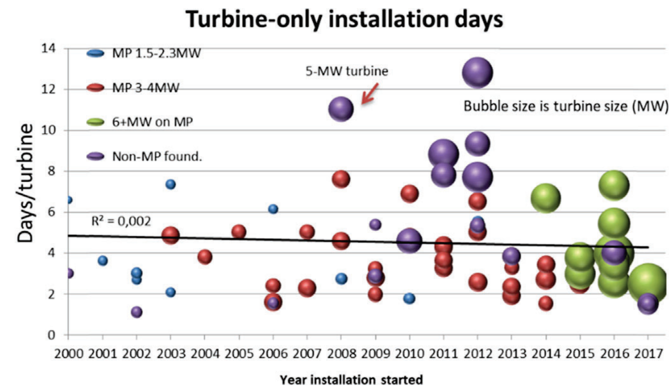


Fig. 10. Evolution of the turbine-only installation days and turbine size for monopile-based installations with turbines between 1.5 and 2.3 MW (blue) between 3 and 4 MW (red), and larger than 6 MW (green), as well as non-monopile-based installations of any turbine rating (purple). Source: own database. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.).

There is a certain correlation between wind farm size and installation time but this correlation has not evolved with technology or process learning.

The reduction in the time of installation per MW between two samples (2000–2003 and 2017) reached 87%, from 2.47 down to 0.30 days/MW.

5. Turbine installation: results and discussion

Turbine installation is generally independent of the kind of foundation used, and thus this analysis of turbine installation includes turbines on all kinds of foundations.

Has the installation of turbines obtained the same efficiency gains as in the case of the monopile foundations?

Fig. 10 shows that the data have a high level of dispersion, and suggests that turbine installation is nowadays ***only marginally*** more efficient per turbine. This graph shows the turbine installation rate for European OWFs[7] from 2000. The trend line shows only a very slight sign of a reduction in installation time. Therefore, when considered from the point of view of installing only the turbine, the improvement is marginal. Still, it should be noted that turbines have been increasing in size, and this increase makes installation time longer because:

(a) Methods and procedures to install that were learnt and already well managed are not necessarily valid with the larger turbines, and
(b) Larger cranes are needed which may render old vessels unusable.

The size of the bubbles, which represents the size of the wind turbines, hints a more positive view: the installation time per megawatt has been reduced radically, as shown in the following paragraphs and figures.

Fig. 11 plots the time needed to install turbines in megawatts terms for the whole set of turbines and only for turbines installed on monopiles. The vertical axis has been trimmed in order to better show the important points. This leaves out of the picture three wind farms installed in 2000, 2003 and 2006, plus BARD.

The weighted average turbine installation rate **increased** from 2.92 days/turbine in the 9 wind farm built in the period 2000–2003 to 3.39 days for the 12 projects started in 2016–2017 and already finished. However, the installation rate per megawatt of the same set of wind

[7] One OWF is actually not shown in the graph, BARD Offshore 1, at 26.6 days/turbine. It started installing in 2010 and finished three years later with up to four vessels installing turbines. The developer went bankrupt.