# Appendix I

# Draft General Conformity Determination

# Draft General Conformity Determination
# Cape Wind Energy Project

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## TABLE OF CONTENTS



**Figure**



**Tables**



**Appendix**

## 1.0 INTRODUCTION TO THE PROPOSED ACTION

The Cape Wind Energy Project developer, Cape Wind Associates, LLC (the applicant), proposes to build, operate, and eventually decommission an electric generation facility with a maximum electric output of 468 megawatts and an average output of 182.6 megawatts, in Federal waters in Nantucket Sound off the coast of Massachusetts (proposed action). The proposed action would generate electricity from wind energy resources on the Outer Continental Shelf. The applicant seeks to commence construction in 2009 and begin full operation in 2011.

The applicant requests a lease, easement, right-of-way, and any other related approvals from the Department of the Interior, Minerals Management Service necessary to authorize construction, operation and eventual decommissioning of the proposed action. The Minerals Management Service's authority to approve, deny, or modify the Cape Wind Energy Project derives from the Energy Policy Act of 2005 (EPAct). Information may be found at http://www.mms.gov/2005EnergyPolicyAct.htm#Renewables. Section 388 of the Act amended the Outer Continental Shelf Lands Act by adding subsection 8(p), which authorizes the Department of the Interior to grant leases, easements or right-of-ways on Outer Continental Shelf lands for activities that produce or support production, transportation, or transmission of energy from sources other than oil and gas, such as wind power.

The proposed project would consist of the following components:

- An array of 130 wind turbine generators (WTG) arranged in a grid pattern in the Horseshoe Shoal region of Nantucket Sound, Massachusetts;
- An interconnecting 33-kV solid dielectric submarine inner-array cable system running from the wind turbine generators to an electrical service platform (ESP);
- A 115-kV submarine transmission cable system approximately 12.5 miles in length (7.6 miles of it within Massachusetts state waters) running from the electric service platform to a landfall location in Yarmouth, Massachusetts;
- An onshore transmission cable system approximately 6.9 mi in length between landfall and the Barnstable switching station along the NSTAR electric right-of-way; and
- A staging site during the construction phase at the Quonset Davisville Port & Commerce Park in the town of North Kingstown, Rhode Island.

Offshore emissions would be associated with transport vessels, barges, tugboats, cranes, pile drivers, and crew boats. Onshore emissions associated with the construction of the 115kV cable would consist of excavators, backhoes, trenchers, dump trucks, drill rigs, cranes, and graders. At Quonset emissions would be associated with transport vessels, cranes, and vehicles at the staging site.

The proposed Cape Wind Project would be located in an area that has not been classified for air because such classifications do not apply to Federal waters. The Massachusetts counties surrounding the project site (Barnstable, Bristol, Dukes, and Nantucket) are located within the Eastern Massachusetts moderate non-attainment area for the national ambient air quality standard (NAAQS) for 8-hour average ozone levels. These counties are in attainment of the NAAQS for all other criteria pollutants. The staging area at Quonset Davisville Port is located

within the Rhode Island moderate non-attainment area for 8-hour average ozone. Projected emissions of nitrogen oxides ($NO_x$) that would be associated with the proposed Cape Wind Project exceed the 100 tons per year threshold within each of the Massachusetts and Rhode Island jurisdictions. Therefore a conformity determination analysis was conducted.

## 2.0 GENERAL CONFORMITY REGULATORY BACKGROUND

The EPA promulgated the General Conformity Rule on November 30, 1993 in Volume 58 of the Federal Register (58 FR 63214) to implement the conformity provision of Title I, section 176(c)(1) of the CAA. Section 176(c)(1) requires that the federal government not engage in, support, or provide financial assistance for licensing, permitting, or approving any activity not conforming to an approved CAA implementation plan. The approved implementation plan could be a Federal, State, or Tribal Implementation Plan (i.e., FIP, SIP, or TIP).

The General Conformity Rule is codified in Title 40 of the Code of Federal Regulations (CFR) Part 51, Subpart W and Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans." The General Conformity Rule applies to all federal actions except highway and transit programs. The latter must comply with the conformity requirements for transportation plans in 40 CFR Part 93, Subpart A.

## 2.1 GENERAL CONFORMITY REQUIREMENTS

Title I, section 176(c)(1), of the CAA defines conformity as the upholding of "an implementation plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving attainment of such standards." Conforming activities or actions should not, through additional air pollutant emissions:

- Cause or contribute to new violations of any NAAQS in any area;
- Increase the frequency or severity of any existing violation of any NAAQS; or
- Delay timely attainment of any NAAQS or interim emission reductions.

The General Conformity Rule may be implemented in coordination with and as part of the National Environmental Policy Act process. The rule takes into account air pollution emissions associated with actions that are federally funded, licensed, permitted, or approved, and ensures that emissions do not contribute to air quality degradation, thus preventing the achievement of state and federal air quality goals. In short, General Conformity refers to the process of evaluating plans, programs, and projects to determine and demonstrate that they meet the requirements of the CAA and applicable SIP. The purpose of the conformity process is to work with federal and state agencies to ensure that a project does not negatively impact a State's control strategy, and identify means of achieving conformity with the SIP.

## 2.2 GENERAL CONFORMITY APPLICABILITY

The proposed Cape Wind Project would be located in Federal waters in Nantucket Sound, an area where the EPA has jurisdiction over air emissions associated with OCS activities authorized

by the Department of the Interior (DOI) under the OCS Lands Act (OCSLA) of 1953 (43 U.S.C. 1331 et seq.). The EPA OCS regulations were mandated by the 1990 Clean Air Act Amendments and promulgated by EPA in 1992 (40 CFR Part 55). At the time of promulgation, the regulations were intended to apply to oil and gas development, production, and extraction facilities. The EPAct amended OCSLA to grant authority to the DOI to manage alternative energy projects on the OCS. The various activities associated with the Cape Wind Project were examined to determine if any of them would be subject to Section 328(a) of the CAA and the implementing regulations in 40 CFR Part 55.

Section 328(a) of the CAA states that OCS activities located within 25 miles from a state's seaward boundary are subject to the same requirements as those applicable to the nearest onshore area, the "Corresponding Onshore Area." On December 7, 2007 Cape Wind submitted to the EPA a Notice of Intent (NOI) as required by 40 CFR 55.4. Subsequently, EPA Region 1 conducted a consistency review and finalized regulations incorporating the relevant Massachusetts air rules into Appendix A to 40 CFR Part 55 (September 17, 2008 Federal Register, p 53718).

Section 328 (a)(4)(c) of the CAA defines an OCS source to include any equipment, activity, or facility (1) which emits, or has the potential to emit, any air pollutant, (2) is regulated or authorized under the OCSLA, and (3) is located on the OCS or in or on waters above the OCS. This definition also includes emissions from any vessel servicing or associated with an OCS source, including emissions while at the OCS source or en route to or from the OCS source within 25 miles of the OCS source. The proposed action has three distinct time periods during which OCS sources and the vessels servicing them would emit, or have the potential to emit, air pollutants: preconstruction geologic and geophysical (G&G) data gathering stage, the two-year construction period and the decommissioning period.

EPA considers vessels to be exempt from the definition of an OCS source unless they are attached to the ocean bottom or are en route to a structure or facility defined as an OCS source. The OCS sources for the proposed action would be the vibracore boat and diesel powered boring equipment, the jack-up barges and the diesel powered cranes or hydraulic rams on those jack-up barges that are directly attached to the ocean bottom using jack-up legs or spud piles and the support vessels servicing these OCS sources while en route to or from the OCS source within 25 miles of the OCS source. The following equipment and activities are subject to permitting by the EPA as OCS sources:

- Post lease G&G sampling and data gathering stage: equipment associated with the seafloor boring program (vibracore boat and diesel powered boring equipment).
- Construction period: pile installation, installation of scour protection, offshore cable laying, installation of the ESP, and installation of the WTG; vessels including crane barges (if attached to the ocean bottom) and attendant barges (if attached to the ocean bottom); and equipment including hydraulic rams and diesel powered cranes.

- Operational phase: a diesel powered crane on the ESP.
- Decommissioning: jack-up barges, diesel powered cranes, and dredgers.
- All phases: emissions from tugboats, crew boats, supply vessels, and maintenance vessels en route to or from the OCS sources when they are within 25 miles (40 km) of the source.

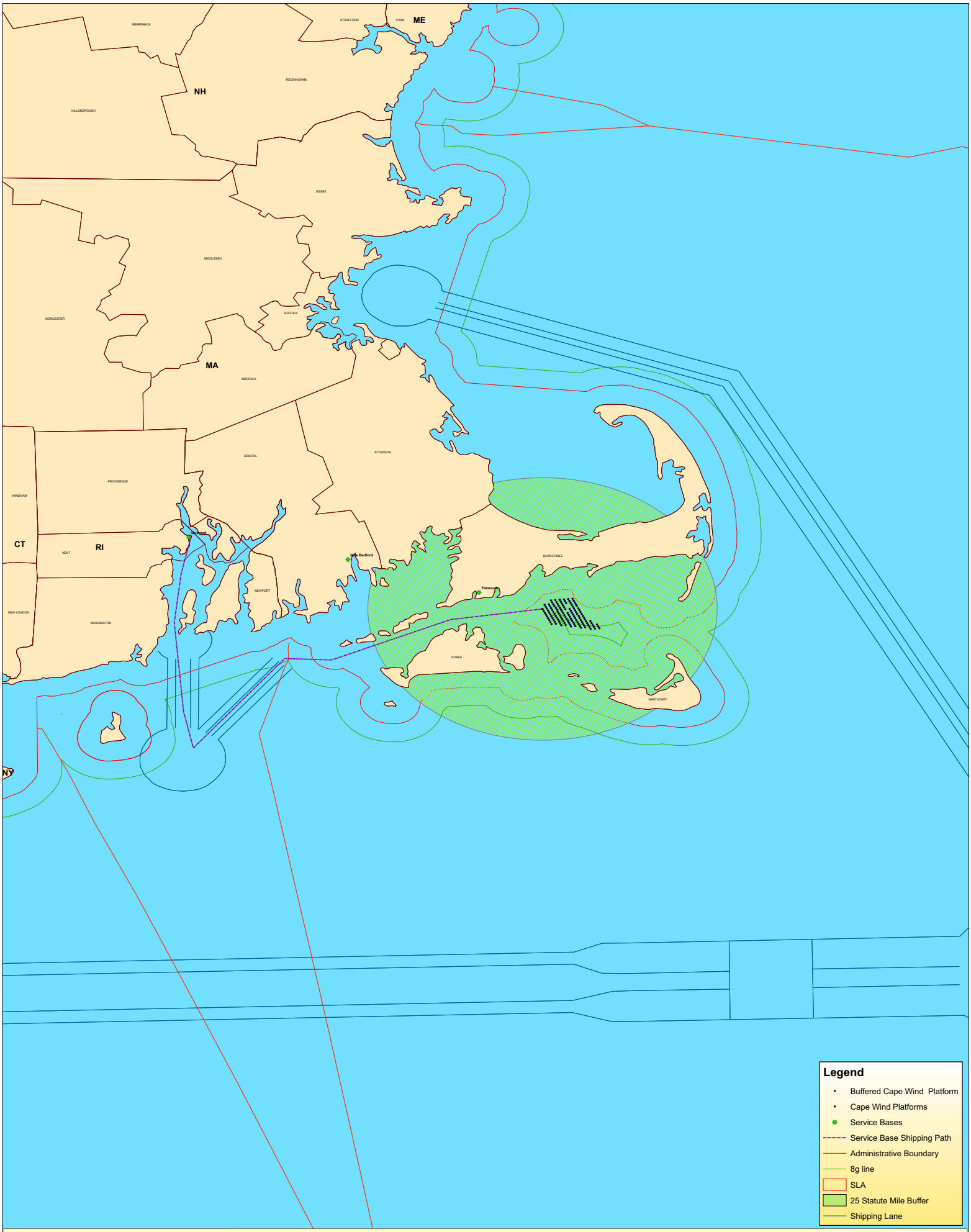
Any of these OCS source would be subject to 40 CFR Part 55, which incorporates the applicable sections of Commonwealth of Massachusetts Department of Environmental Protection rules 310 CMR 4.00, 310 CMR 6.00, 310 CMR 7.00, and 310 CMR 8.00. They would thus be exempt from Massachusetts conformity requirements.

## 3.0 ASSESSMENT OF PROJECT EMISSIONS

Emissions from offshore activities were determined using EPA AP-42 emission factors. For marine vessels, $NO_x$ emission factors were set equal to the EPA Tier 1 emission standards. Cape Wind would employ vessels that comply with these standards. Onshore construction emissions were calculated using EPA's model guidance for non-road engines and vehicles.

Figure 1 shows the geographic area that is within 25 miles of the Cape Wind Project area. Within this zone, emissions from vessels associated with construction activities will be included in the OCS permit required under 40 CFR 55 and thus will not be subject to conformity. Crew boats servicing the Cape Wind construction site would originate in Falmouth, MA. The route is entirely within the 25-mile zone and thus these emissions will be included in the OCS permit. Barges and transport vessels for the installation of the piles, wind turbines, scour protection, ESP, and cables would originate at Quonset Point, RI. These vessels would traverse Rhode Island waters, OCS waters (outside the 3-mile state seaward boundary), Massachusetts waters, and then again OCS waters as they approach Cape Wind (Figure 1). Vessels traversing State waters were included in the conformity analysis unless they are within 25 miles of Cape Wind. All vessels within the 25-mile zone would be included in the EPA OCS permit and will not be subject to conformity. Vessels on OCS waters outside the 25-mile zone and outside any of the State boundaries would be subject to neither conformity nor permitting.

Table 1 shows the projected $NO_x$ and VOC emissions for the preconstruction G&G sampling and data gathering activities. Falmouth, MA would be used as a base for the vessels. All emissions would therefore occur within 25 miles of the activities and be subject to an EPA air permit. No preconstruction emissions will be subject to conformity.




CAPE WIND ENERGY PROJECT
Cape Wind Air Quality Map
Figure 1

The construction phase emissions are shown in Table 2. Construction would take place over a period of two years; however, because of uncertainties in the construction schedule, a worst-case scenario was used where all emissions are considered to take place in a single year. Total $NO_x$ emissions are projected to be 863.4 tons. Of these emissions, 266.4 tons would be subject to the EPA OCS permit. The $NO_x$ emissions for Massachusetts and Rhode Island exceed the 100 tons per year *de minimis* threshold for a moderate ozone nonattainment area. The $NO_x$ emissions subject to conformity in Massachusetts and Rhode Island are 122.9 and 356.4 tons, respectively. Finally, there are 177.7 tons of $NO_x$ that are subject to neither permitting nor conformity. The VOC emissions are all well below the *de minimis* conformity.

Table 3 shows the estimated emissions of $NO_x$ and VOC for the operations phase, which is estimated to occur over a 20-year period. Almost all of the emissions would occur within 25 miles of the Cape Wind Project and would be covered by an EPA air permit as appropriate. Emission rates within Massachusetts jurisdiction would be well below the *de minimis* conformity threshold. There would be no operating emissions in Rhode Island.

Emissions associated with decommissioning activities at the end of the project were not included in the conformity determination. MMS will prepare a separate conformity determination should it be needed at that stage of the project.

The following sections present the conformity emissions in more detail for each of the two state jurisdictions.

## 3.1 CONFORMITY EMISSIONS – MASSACHUSETTS

Emission sources associated with the installation of the onshore portion of the 133 kV power cable in Massachusetts would include construction equipment such as excavators, backhoes, trenchers, borehole drill rigs, front end loaders, graders, and on-road mobile sources that include dump trucks, heavy-duty delivery trucks, and worker transport vehicles. Construction work would involve breaking pavement or stripping of topsoil, trench excavation, drilling, concrete casting, backfilling, supply trucks, and worker transport. These activities would occur over a period of about 150 days and would generate 23.0 tons of $NO_x$ and 8.2 tons of VOC. Detailed information on the equipment and calculations can be found in Table A-1 in Appendix A.

During the construction phase, vessel emissions in the portion of Massachusetts state waters within 25 miles of the project site would be included in the EPA OCS air permit and thus would not be subject to conformity. These include the emissions from the crew boats traveling from Falmouth, MA to the construction site as well as the emissions from the activities associated with the installation of the 133 kV cable from the 3-mile state seaward boundary to the point where the cable makes landfall in Yarmouth, MA.

| Table 1. Cape Wind Energy Project Estimated Emissions During Pre-Construction Geological and Geophysical Data Gathering | | |
|---|---|---|
| | **Total emissions, tons/yr** | |
| | | VOC |
| | | |
| Drill Rig and Vessels | 20.0 | 0.8 |

| Table 2. Cape Wind Energy Project Estimated Emissions for Construction Phase | | |
|---|---|---|
| | **Total emissions[1], tons** | |
| | **$NO_x$** | **VOC** |
| | | |
| Emissions under EPA OCS permit (40 CFR 55) | | |
| Stationary sources at project site | 22.6 | 1.6 |
| Vessels within 25 mi of project | 243.8 | 12.3 |
| Subtotal | **266.4** | **13.8** |
| Emissions not under State air permit - Massachusetts | | |
| Onshore construction in MA | 23.0 | 8.2 |
| Vessels in MA waters more than 25 mi from project | 99.9 | 4.8 |
| Subtotal | **122.9** | **13.0** |
| Emissions not under State air permit - Rhode Island | | |
| Quonset, RI staging area | 96.3 | 5.2 |
| Vessels in RI waters | 260.1 | 12.5 |
| Subtotal | **356.4** | **17.7** |
| | | |
| Other emissions | | |
| Vessels in Federal waters more than 25 mi from project | **117.7** | **5.7** |
| | | |
| TOTAL | **863.4** | **61.5** |

1. These emissions are scheduled to take place over a period of 2 years; however, because of uncertainties in the construction schedule, all emissions are considered to take place in a single year for permitting and conformity purposes.

| Table 3. Cape Wind Energy Project Estimated Emissions During Operations | | |
|---|---|---|
| | **Total emissions, tons/yr** | |
| | **$NO_x$** | **VOC** |
| Project Emissions | | |
| Stationary sources at project site | 0.1 | <0.1 |
| Vessels in MA and OCS waters | 20.1 | 1.2 |
| TOTAL | **20.2** | **1.3** |

Barges and transport vessels for the installation of the piles, wind turbines, scour protection, ESP, and cables would originate from Quonset Point, RI. A 7.3 nautical miles (nmi) segment of the route lies within Massachusetts state waters outside the 25-mile zone around Cape Wind. The installation of the piles would involve two round trips by a tugboat for moving a jack up barge and two round trips for moving a barge used in the installation of scour control systems. The vast majority of the vessels would be equipped with diesel engines with a combined 6,000 hp rated capacity. There would be 366 round trips by tugboat to transport piles and scour protection materials. The cable laying activities would require two round trips for the 115 kV cable laying barge, two round trips for a crane barge, and 13 round trips for the 33 kV cable laying barge. The $NO_x$ emission factor was 6.86 g/hp-hr, which is equivalent to the Tier 1 emission standards for marine vessel engines.

For the turbine installation, there would be 43 round trips by a specialized vessel to transport the turbines to the installation site. The ESP installation would involve 4 round trips for a crane barge and two round trips each to transport the piles and the ESP deck. It was assumed that each vessel would traverse the segment of Massachusetts state waters outside the 25-mile zone in 3 hours (one-way), a very conservative assumption. The total $NO_x$ emissions from vessels in Massachusetts state waters subject to conformity is 99.9 tons (Table A-2, Appendix A).

The sum of onshore construction emissions and vessel emissions subject to conformity in Massachusetts is 122.9 tons of $NO_x$.

## 3.2 CONFORMITY EMISSIONS – RHODE ISLAND

A staging site for all Cape Wind construction operations would be located on the Port of Davisville at Quonset Point in Rhode Island. Most of the components, materials, and supplies are expected to arrive via cargo barge. A total of 427 visits of cargo barge are planned, primarily utilizing 6,000 hp tow tugs. One of two existing docks at the Port of Davisville would be used for arrival and departure of vessels. The vessel would travel a distance of about 32 nautical miles round trip through RI waters. Assuming a speed of 8 knots, the duration would be 4 hours per port visit.

No new structures would be built at the site. An 800-hp crane would be employed at the docking facility to load and unload components and materials for the Cape Wind Project. It was assumed that there would be 427 loading and unloading operations lasting 8 hours per loading/unloading cycle. The total $NO_x$ emissions from staging activities at Quonset are 21.1 tons (Table A-3, Appendix A).

Barges and transport vessels for the installation of the piles, wind turbines, scour protection, ESP, and cables would originate from Quonset Point, RI. A 19 nautical miles (nmi) segment of the route lies within Rhode Island state waters. The installation of the piles would involve two round trips by a tugboat for moving a jack up barge and two round trips for moving a barge used in the installation of scour control systems. The vast majority of the vessels would be equipped with diesel engines with a combined 6,000 hp rated capacity. There would be 366 round trips by

tugboat to transport piles and scour protection materials. The cable laying activities would require two round trips for the 115 kV cable laying barge, two round trips for a crane barge, and 13 round trips for the 33 kV cable laying barge.

For the turbine installation, there would be 43 round trips by a specialized vessel to transport the turbines to the installation site. The ESP installation would involve 4 round trips for a crane barge and two round trips each to transport the piles and the ESP deck. It was assumed that each vessel would traverse the segment of Rhode Island state waters in 7 hours (one-way), a very conservative assumption. The total $NO_x$ emissions from vessels in RI state waters subject to conformity is 335.3 tons (Table A-4, Appendix A).

A total of 356.4 tons of $NO_x$ emissions is subject to conformity in Rhode Island.

## 4.0 GENERAL CONFORMITY DETERMINATION

In accordance with General Conformity requirements listed in Title 40 CFR Part 93.158(a) and (c), in order for a federal agency to issue a conformity determination, the following criteria must be met:

- the project must comply with the control measures and regulations that are relied upon in the applicable SIP; and
- the total of direct and indirect emissions for the proposed project must be specifically identified and accounted for in the SIP's attainment demonstration; or
- the total of direct and indirect emissions for the proposed project must be offset through a revision in the SIP or similar enforceable measure so that there is no net increase in emissions; or
- for any criteria pollutant, except ozone, the total of direct and indirect emissions for the proposed project must be evaluated through an area-wide and/or local air quality modeling analysis that shows that the action does not cause or contribute to any new violation of any standard in any area or increase the frequency of severity of any existing violation of any standard in any area.

The following sections describe how the project would conform to these requirements for each of the respective states.

## 4.1 MASSACHUSETTS

On January 31, 2008 the Commonwealth of Massachusetts published its final State Implementation Plan (SIP) to demonstrate attainment of the National Ambient Air Quality Standard for 8-hour average ozone for the Eastern and Western Massachusetts ozone nonattainment area with a compliance date by the end of the 2009 ozone season. The SIP submission included the 2002 Massachusetts Base Year Emissions Inventory, which estimated Massachusetts 2002 in-state emissions of pollutants that contribute to ozone formation. The inventory served as the base year for estimating emissions in 2008 and 2009, as required for the reasonable further progress (RFP) and attainment demonstrations. The Massachusetts Department of Environmental Protection (MDEP) has also included 2012 emissions projections

to demonstrate that emissions from Massachusetts sources will continue to decrease in subsequent years.

Massachusetts has the same emission standards for nonroad mobile sources and marine diesel engines as those promulgated by EPA and has applied these standards in generating the emission inventories for the demonstration of RFP and attainment. The emission sources associated with the Cape Wind Project would be subject to the EPA standards and therefore would be consistent with the Massachusetts SIP.

The estimated emissions from the Cape Wind Project were not specifically identified or accounted for in the SIP. As a result, a total of 122.9 tons of $NO_x$ emission offsets would need to be offset.

Cape Wind has investigated the availability of emission offsets in Massachusetts. The Massachusetts Emission Reduction Credit (ERC) Registry as of June 17, 2008 showed a total of more than 3000 tons of $NO_x$ available from a large group of sources (letter from Mike Feinblatt, ESS Group, Inc. to Rodney Cluck, MMS dated October 31, 2008).

Should the Cape Wind Project be approved by MMS, the lease that would be issued to Cape Wind will contain a stipulation that states that prior to commencing construction activities, Cape Wind shall purchase the offsets needed to conform to the Massachusetts SIP. Cape Wind shall also submit to MMS a record of the number of hours of use for all equipment and vessels. Cape Wind shall also report fuel use for all phases of construction. MMS will use this information to verify that emissions are within the values assumed in the conformity determination.

An air quality modeling analysis using the Offshore and Coastal Dispersion (OCD) version 5 model was used to determine compliance with National and State ambient air quality standards (AAQS) for nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), particulate matter ($PM_{10}$ and $PM_{2.5}$), and carbon dioxide (CO). The highest annual average concentrations of $NO_2$, $SO_2$, and $PM_{2.5}$ occurred over Nantucket Sound just outside the boundary of the wind farm project area. The highest 24-hour average concentrations of $SO_2$, $PM_{10}$, and $PM_{2.5}$ and the highest 3-hour average concentration of $SO_2$ occurred along the 115 kV cable installation route just offshore Hyannis Port, MA. The highest 8-hour and 1-hour average CO concentrations also occurred just off Hyannis. All modeled concentrations were within the national and state AAQS.

## 4.2 RHODE ISLAND

The Rhode Island Department of Environmental Management (RI DEM) submitted to the EPA its State Implementation Plan to demonstrate attainment of the 8-hour National Ambient Air Quality Standard for Ozone in the Rhode Island Nonattainment Area. The standard is to be achieved by the end of the 2009 ozone season. This document also demonstrates that by 2008 Rhode Island will achieve the Reasonable Further Progress (RFP) goals that are prescribed by the Clean Air Act (CAA) and subsequent EPA guidance.

Rhode Island has the same emission standards for nonroad mobile sources and marine diesel engines as those promulgated by EPA and has applied these standards in generating the emission inventories for the demonstration of RFP and attainment. The emission sources associated with the Cape Wind project would be subject to the EPA standards and therefore would be consistent with the Rhode Island SIP.

The estimated emissions from the Cape Wind Project were not specifically identified or accounted for in the SIP. As a result, a total of 356.4 tons of $NO_x$ emission offsets would need to be offset.

Cape Wind has identified a potential of up to 499 tons of $NO_x$ ERCs that could be available in Rhode Island (letter from Mike Feinblatt, ESS Group, Inc. to Rodney Cluck, MMS dated October 31, 2008). This would sufficient to meet the requirements for conformity for the Cape Wind Project. Cape Wind will be obligated as part of the terms for the lease from MMS to purchase the needed offsets before construction activities commence.

Should the Cape Wind Project be approved by MMS, the lease that would be issued to Cape Wind will contain a stipulation that requires that prior to commencing construction activities, Cape Wind shall purchase the offsets needed to conform to the Rhode Island SIP. Cape Wind shall also submit to MMS a record of the number of hours of use for all equipment and vessels. Cape Wind shall also report fuel use for all phases of construction. MMS will use this information to verify that emissions are within the values assumed in the conformity determination.

As stated in the discussion for Massachusetts conformity, a modeling analysis was conducted to determine that all criteria pollutants would meet the National and state AAQS. Modeling was done for points along the vessel route between Quonset and Cape Wind. Modeled concentrations were within the National and state AAQS. While no modeling was done for points off Rhode Island, impacts should be similar.

## 4.3 SUMMARY

Based on the analysis presented here, the Cape Wind construction activities should meet Massachusetts and Rhode Island conformity requirements on the condition that Cape Wind purchases sufficient Emission Reduction Credits to offset projected emissions. Should the Cape Wind Project be approved by MMS, the bureau will issue a lease to Cape Wind that will stipulate that prior to commencing construction activities, Cape Wind shall purchase the offsets needed to conform to the Massachusetts and Rhode Island SIPs. Furthermore, MMS will ensure that the purchase of the ERCs meets the approval of the two states before Cape Wind may start construction. Commencement of construction will also be contingent on Cape Wind obtaining the needed air permit from EPA as well as any other permits needed from Federal, State, and local entities as required by law and regulation.

# Appendix A

# AIR EMISSION CALCULATION SPREADSHEETS

**Table A-1. Cape Wind Energy Project**
**Emissions from Onshore Construction Activities - Massachusetts**

**Emission Factors (g/hp-hr) from EPA's Nonroad Engine Model Guidance Document, EPA420-P-04-009**

| Equipment | NOx | VOC |
|---|---|---|
| Backhoes | 7.220 | 1.850 |
| Bore/Drill Drigs | 7.150 | 0.600 |
| Cement Mixers | 7.280 | 0.610 |
| Dump Trucks | 5.490 | 0.440 |
| Excavators | 4.600 | 0.340 |
| Front End Loaders | 5.000 | 0.380 |
| Graders | 4.730 | 0.350 |
| Trenchers | 5.810 | 0.510 |

**Emission Factors (g/mile) from EPA's MOBILE6 Vehicle Model Guidance Document, EPA420-F-05-022**

| Vehicle | NOx | VOC |
|---|---|---|
| Heavy-Duty Trucks | 4.97 | 0.29 |
| Pick-up Trucks | 1.22 | 1.61 |

**Emission Factors (g/hp-hr) for Diesel Recip. Engines <600 hp**

| Equipment | NOx ** | TOC * |
|---|---|---|
| Crane/Winch | 6.86 | 1.14 |

* Source: AP-42, Vol. I, Tables 3.4-1 - 3.4-4; the TOC figure is used for VOC
** NOx emission factor used is the Tier 1 Emission Standard for nonroad engines (40 CFR 89.112(1))

| Activity Type | Emission Source | Number of Sources | Equipment Size (HP) | Equipment Size (kW) | Activity | Count | Duration | Operating Hours (per unit) | Units | Emissions (tons) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | NOx | VOC |
| **Construction Period - Onshore - Massachusetts** | | | | | | | | | | | |
| **Ductbank, Conduit, and Vault Installation** | | | | | | | | | | | |
| Breaking Pavement/Stripping Topsoil | Excavators | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.1 | 0.1 |
| | Backhoes | 1 | 100 | 75 | | 75 days | 10 hrs/day | 750 | hours | 0.6 | 0.2 |
| | Dump Trucks | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.4 | 0.1 |
| Trench Excavation | Excavators | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.1 | 0.1 |
| | Trenchers | 1 | 175 | 131 | | 75 days | 10 hrs/day | 750 | hours | 0.8 | 0.1 |
| | Dump Trucks | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.4 | 0.1 |
| | Bore/Drill Rigs | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.8 | 0.1 |
| HDD Boring | HDD Drill Rig | 1 | 300 | 224 | | 20 days | 10 hrs/day | 200 | hours | 0.5 | 0.0 |
| Concrete Casting of Ductbank | Cement Mixer | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.8 | 0.2 |
| Install Manholes | Front End Loaders | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.2 | 0.1 |
| Backfill Ductbank | Excavators | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.1 | 0.1 |
| | Backhoes | 1 | 100 | 75 | | 75 days | 10 hrs/day | 750 | hours | 0.6 | 0.2 |
| | Dump Trucks | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.4 | 0.1 |
| | Graders | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.2 | 0.1 |
| Delivery of Supplies | Heavy-Duty Trucks | 2 | | - | | 150 days | 60 mi/day | 18,000 | miles | 0.2 | 0.0 |
| Worker Transport | Pick-up Trucks | 10 | | - | | 150 days | 120 mi/day | 180,000 | miles | 2.4 | 3.2 |
| **Subtotal** | | | | | | | | | | **18.6** | **4.7** |
| **115kV Transmission Line Installation** | | | | | | | | | | | |
| Cable Pulling | Heavy-Duty Trucks | 1 | | - | | 75 days | 10 mi/day | 750 | miles | 0.0 | 0.0 |
| | Winch | 1 | 300 | 224 | | 75 days | 10 hrs/day | 750 | hours | 1.7 | 0.3 |
| Power Pole Installation | Bore/Drill Rigs | 1 | 300 | 224 | | 2 days | 10 hrs/day | 20 | hours | 0.0 | 0.0 |
| | Crane | 1 | 400 | 298 | | 2 days | 10 hrs/day | 20 | hours | 0.1 | 0.0 |
| | Heavy-Duty Trucks | 1 | | - | | 2 days | 10 mi/day | 750 | miles | 0.0 | 0.0 |
| Delivery of Supplies | Heavy-Duty Trucks | 2 | | - | | 150 days | 60 mi/day | 18,000 | total miles | 0.2 | 0.0 |
| Worker Transport | Pick-up Trucks | 10 | | - | | 150 days | 120 mi/day | 180,000 | total miles | 2.4 | 3.2 |
| **Subtotal** | | | | | | | | | | **4.4** | **3.5** |
| **TOTAL Emissions Over Construction Duration** | | | | | | | | | | **23.0** | **8.2** |

**Tabe A-2. Cape Wind Energy Project**
**Construction Pahe Vessel Transit Emissions in MA Waters Subject to Conformity**

**Note: All trips are one-way (not round trips).**

**Emission Factors (g/hp-hr) Diesel Recip. >600 hp Based on AP-42 Vol.1 , Tables 3.4-1 - 3.4-4**

| NOx ** | VOC |
|---|---|
| 6.86 | 0.33 |

**Emission Factors (g/hp-hr) Diesel Recip. <600 hp Based on AP-42 Vol.1 , Tables 3.3-1 - 3.3-2**

| NOx ** | TOC* |
|---|---|
| 6.86 | 1.14 |

* Emission factor for VOC was not available; TOC emission factor is used instead, which will result in a very conservative estimation of VOC emissions.
** NOx emission factor used is the Tier 1 Emission Standard for nonroad engines (40 CFR 89.112(1)).

| Activity Type | Vessel Type / Emission Source | Number of Sources | Equipment Size (HP) | Equipment Size (kW) | Activity | Count | Duration ( hrs/trip) | Operating Hours (per unit) | Assumptions | Emissions (tons) NOx | Emissions (tons) VOC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Period - Activities beyond 25 Miles of the Project and in MA Waters** | | | | | | | | | | | |
| Move jack up barge | attendant tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 4 trips | 3 | 10 | | 0.24 | 0.01 |
| Transport piles and transition pieces | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 86 trips | 3 | 225 | avg. 3 piles per trip, 130 piles | 10.19 | 0.49 |
| Move scour installation equipment | attendant tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 4 trips | 3 | 10 | This is done twice (once per year) | 0.24 | 0.01 |
| Transport rock armor barges | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 276 trips | 3 | 722 | Spd. 8 knts | 32.71 | 1.57 |
| Transport filler material barges | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 370 trips | 3 | 967 | Spd. 8 knts | 43.85 | 2.11 |
| **Subtotal** | | | | | | | | | | **87.2** | **4.2** |
| **Cable laying** | | | | | | | | | | | |
| 115 kV Cable laying barge | tow tug | 1 | 1,500 | 1,119 | Trips to/fr Quonset Point, RI | 4 trips | 3 | 10 | | 0.12 | 0.01 |
| 33 kV Cable laying barge | tow tug | 1 | 1,500 | 1,119 | Trips to/fr Quonset Point, RI | 26 trips | 3 | 68 | 13 round trips | 0.77 | 0.04 |
| Move Crane barge to cofferdam location | tow tug | 1 | 1,500 | 1,119 | Trips to/fr Quonset Point, RI | 4 trips | 3 | 10 | | 0.12 | 0.01 |
| **Subtotal** | | | | | | | | | | **1.0** | **0.0** |
| **Turbine installation** | | | | | | | | | | | |
| Turbines | one specialized vessel | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 86 trips | 3 | 225 | | 10.19 | 0.49 |
| **Subtotal** | | | | | | | | | | **10.2** | **0.5** |
| **ESP Installation** | | | | | | | | | | | |
| Crane barge towing | tow tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 2 trips | 8 | 16 | 12 hrs. out, 12 hours back ( prorated for traveling beyond 25- | 0.36 | 0.02 |
| Pile Installation barge towing | tow tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 2 trips | 6 | 12 | 12 hrs. out, 6 hours back ( prorated for traveling beyond 25-mile) | 0.27 | 0.01 |
| ESP deck to wind farm | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 2 trips | 6 | 12 | 12 hrs. out, 6 hours back ( prorated for traveling beyond 25-mile) | 0.53 | 0.03 |
| Crane barge towing | tow tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 2 trips | 8 | 16 | 12 hrs. out, 12 hours back ( prorated for traveling beyond 25-mile) | 0.36 | 0.02 |
| **Subtotal** | | | | | | | | | | **1.5** | **0.1** |
| **TOTAL Construction Emissions Over 2-year Construction Duration** | | | | | | | | | | **99.9** | **4.8** |

Note: Hours were prorated based on the following assumptions:
- MA Border to 25-mile limit = 7.3 Miles
- Falmouth to Wind Park = 11.17 Miles
- Miles are nautical milles

**Table A-3. Cape Wind Energy Project**
**Emissions from Quonset Point Staging Site - Rhode Island**

**Emission Factors (g/mi) from EPA's MOBILE6 Vehicle Model Guidance Document, EPA420-F-05-022**

| Vehicle | NOx | VOC |
|---|---|---|
| Pickup truck/SUV | 1.22 | 1.61 |

**Emission Factors (g/hp-hr)**

| Equipment | NOx ** | VOC * |
|---|---|---|
| Diesel Engine | 6.86 | 0.33 |

* Source: AP-42, Vol. I, Table 3.4-1; the TOC figure is used for VOC
** NOx emission factor used is the Tier 1 Emission Standard for nonroad engines (40 CFR 89.112(1)).

| Activity Type | Emission Source | Number of Sources | Equipment Size (HP) | Equipment Size (kW) | Activity | Count | Duration | Operating Hours (per unit) | Units | Emissions (tons) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | NOx | VOC |
| **Construction Period - Onshore - Rhode Island** | | | | | | | | | | | |
| **Port Worker Commute** | | | | | | | | | | | |
| Vehicle Emissions | pickup trucks/SUV | 25 | | | 240 days | 480 trips | 30 miles/trip | 14,400 | miles | 0.5 | 0.6 |
| **Subtotal** | | | | | | | | | | **0.5** | **0.6** |
| **Delivery of Parts & Materials** | | | | | | | | | | | |
| Cargo Barge Tow Tug - Light | tow tug | 1 | 1,500 | 1,119 | Cable | 15 trips | 4 hrs/trip | 60 | hours | 0.7 | 0.0 |
| Cargo Barge Tow Tug - Middle | tow tug | 1 | 3,000 | 2,237 | Scour | 2 trips | 4 hrs/trip | 8 | hours | 0.2 | 0.0 |
| Cargo Barge Tow Tug - Heavy | tow tug | 1 | 6,000 | 4,474 | All Else | 410 trips | 4 hrs/trip | 1,640 | hours | 74.3 | 3.6 |
| **Subtotal** | | | | | | | | | | **75.2** | **3.6** |
| **Construction Staging Activities - Unloading/Staging/Loading** | | | | | | | | | | | |
| Piles & Transition Pieces | Crane | 1 | 800 | 597 | | 43 trips | 8 hrs/trip | 344 | hours | 2.1 | 0.1 |
| Scour Installation Equipment | Crane | 1 | 800 | 597 | | 2 trips | 8 hrs/trip | 16 | hours | 0.1 | 0.0 |
| Rock Armor | Crane | 1 | 800 | 597 | | 138 trips | 8 hrs/trip | 1,104 | hours | 6.7 | 0.3 |
| Filler Material | Crane | 1 | 800 | 597 | | 185 trips | 8 hrs/trip | 1,480 | hours | 8.9 | 0.4 |
| 115 kV Cable | Crane | 1 | 800 | 597 | | 2 trips | 8 hrs/trip | 16 | hours | 0.1 | 0.0 |
| 33 kV Cable | Crane | 1 | 800 | 597 | | 13 trips | 8 hrs/trip | 104 | hours | 0.6 | 0.0 |
| Turbines | Crane | 1 | 800 | 597 | | 43 trips | 8 hrs/trip | 344 | hours | 2.1 | 0.1 |
| ESP Deck | Crane | 1 | 800 | 597 | | 1 trip | 8 hrs/trip | 8 | hours | 0.0 | 0.0 |
| **Subtotal** | | | | | | | | **3,416** | | **20.6** | **1.0** |
| **TOTAL Emissions Over Construction Duration** | | | | | | | | | | **96.3** | **5.2** |

Tow tug hours were based on traveling 32 nautical mile round-trips from the RI Border to Quonset Point and back to the RI Border at a speed of 8 knots (4 hours per round trip).
Assumes 8 hours of total crane operating time for unloading/staging/loading for each vessel trip.
All operating hours will be metered to track actual emissions.

**Table A-4. Cape Wind Energy Project**
**Construction Phase Vessel Transit Emissions in RI Waters Subject to Conformity**

**Note: All trips are one-way (not round trips).**

**Emission Factors (g/hp-hr) Diesel Recip. >600 hp Based on AP-42 Vol.1 , Tables 3.4-1 - 3.4-4**

| NOx ** | VOC |
|---|---|
| 6.86 | 0.33 |

**Emission Factors (g/hp-hr) Diesel Recip. <600 hp Based on AP-42 Vol.1 , Tables 3.3-1 - 3.3-2**

| NOx ** | TOC* |
|---|---|
| 6.86 | 1.14 |

* Emission factor for VOC was not available; TOC emission factor is used instead, which will result in a very conservative estimation of VOC emissions.
** NOx emission factor used is the Tier 1 Emission Standard for nonroad engines (40 CFR 89.112(1)).

| Activity Type | Vessel Type / Emission Source | Number of Sources | Equipment Size (HP) | Equipment Size (kW) | Activity | Count | Duration ( hrs/trip) | Operating Hours (per unit) | Assumptions | Emissions (tons) NOx | Emissions (tons) VOC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Period - Activities beyond 25 Miles of the Project and in RI Waters** | | | | | | | | | | | |
| Move jack up barge | attendant tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 4 trips | 7 | 27 | | 0.62 | 0.03 |
| Transport piles & transition pieces | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 86 trips | 7 | 585 | avg. 3 piles per trip, 130 piles | 26.53 | 1.28 |
| Move scour installation equipment | attendant tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 4 trips | 7 | 27 | This is done twice (once per year) | 0.62 | 0.03 |
| Transport rock armor barges | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 276 trips | 7 | 1,878 | Spd. 8 knts | 85.13 | 4.09 |
| Transport filler material barges | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 370 trips | 7 | 2,517 | Spd. 8 knts | 114.12 | 5.49 |
| **Subtotal** | | | | | | | | | | **227.0** | **10.9** |
| **Cable laying** | | | | | | | | | | | |
| 115 kV Cable laying barge | tow tug | 1 | 1,500 | 1,119 | Trips to/fr Quonset Point, RI | 4 trips | 7 | 27 | | 0.31 | 0.01 |
| 33 kV Cable laying barge | tow tug | 1 | 1,500 | 1,119 | Trips to/fr Quonset Point, RI | 26 trips | 7 | 177 | 13 round trips | 2.00 | 0.10 |
| Move Crane barge to cofferdam location | tow tug | 1 | 1,500 | 1,119 | Trips to/fr Quonset Point, RI | 4 trips | 7 | 27 | | 0.31 | 0.01 |
| **Subtotal** | | | | | | | | | | **2.6** | **0.1** |
| **Turbine installation** | | | | | | | | | | | |
| Turbines | one specialized vessel | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 86 trips | 7 | 585 | | 26.53 | 1.28 |
| **Subtotal** | | | | | | | | | | **26.5** | **1.3** |
| **ESP Installation** | | | | | | | | | | | |
| Crane barge towing | tow tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 2 trips | 20 | 41 | 12 hrs. out, 12 hours back ( prorated for traveling beyond 25-mile) | 0.93 | 0.04 |
| Pile Installation barge towing | tow tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 2 trips | 15 | 31 | 12 hrs. out, 6 hours back ( prorated for traveling beyond 25-mile) | 0.69 | 0.03 |
| ESP deck to wind farm | tow tug | 1 | 6,000 | 4,474 | Trips to/fr Quonset Point, RI | 2 trips | 15 | 31 | 12 hrs. out, 6 hours back ( prorated for traveling beyond 25-mile) | 1.39 | 0.07 |
| Crane barge towing | tow tug | 1 | 3,000 | 2,237 | Trips to/fr Quonset Point, RI | 2 trips | 20 | 41 | 12 hrs. out, 12 hours back ( prorated for traveling beyond 25-mile) | 0.93 | 0.04 |
| **Subtotal** | | | | | | | | | | **3.9** | **0.2** |
| **TOTAL Construction Emissions Over 2-year Construction Duration** | | | | | | | | | | **260.1** | **12.5** |

Note: Hours were prorated based on the following assumptions:
- Quonset Point to RI Border = 19 Miles
- Falmouth to Wind Park = 11.17 Miles
- Miles are nautical milles

All operating hours will be metered to track actual emissions.