

US EPA ARCHIVE DOCUMENT

September 23, 2009

David B. Conroy  
Manager, Air Programs Branch  
United States Environmental Protection Agency  
Region 1 Headquarters  
One Congress Street, Suite 1100  
Boston, MA 02114-2023

**Re:    *Revised Emissions Estimates*  
         *Outer Continental Shelf Air Regulations Permit Application*  
         *Cape Wind Energy Project***

Dear Mr. Conroy:

A Permit Application for the proposed Cape Wind Offshore Renewable Energy Project (the Project) was submitted by ESS Group, Inc. (ESS) on December 17, 2008 to fulfill the regulatory requirements of the United States Environmental Protection Agency's (EPA) Outer Continental Shelf (OCS) Air Regulations, codified under Title 40 Code of Federal Regulations, Part 55 (40 CFR § 55). The Project, as proposed by Cape Wind Associates, LLC (Cape Wind), will be located at Horseshoe Shoal, Nantucket Sound, Massachusetts, and will utilize offshore wind energy as its renewable fuel to generate electricity for sale.

ESS has prepared revised emissions estimates for the equipment associated with the construction and operation of the Project. The emission estimates were revised at the direction of the EPA and the Minerals Management Service (MMS) during conference calls held on July 16 and July 29, 2009. The emissions estimated were revised in accordance with the EPA's "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories – Final Report", dated April 2009 (EPA Port Study).

Attached is a memorandum to EPA and MMS, dated July 30, 2009, which details the specific revisions made to the emissions estimates, including revised versions of the spreadsheets used to estimate the emissions for each phase of the project subject to OCS permitting, which were included in Appendix A of the Project's OCS Permit Application. Also attached is a revised version of Table 1-1 from the Project's OCS Permit Application. It summarizes the Project's revised potential emissions during preconstruction, construction, and operation from vessels in transit and from stationary sources that will occur inside 25 miles of the Project site. Table 1-1 also includes revised proposed annual emission limits for Phase 1 (preconstruction and construction) and Phase 2 (operation) of the Project. Finally, Table 1-1 summarizes the revised emission offset requirements for Phase 1 of the Project.

The revised emission estimates for the phases of the Cape Wind Energy Project subject to OCS permitting have been done on a consistent basis, at the direction of EPA and MMS, using the most up to date EPA guidance for such estimations. If you have any questions regarding this submittal, do not hesitate to call me at (781) 489-1149.

Sincerely,

**ESS GROUP, INC.**



**Michael E. Feinblatt**  
Project Manager

Attachments

C: Ida McDonnell, EPA  
Karen Regas, MassDEP  
Craig Olmsted, Cape Wind Associates  
Rachel Pachter, Cape Wind Associates  
Chris Rein, ESS  
Terry Orr, ESS

**Table 1-1**  
**Cape Wind Energy Project**  
**Project Emissions Subject to OCS Permitting - Revised July 2009**

| PHASE 1 - PRECONSTRUCTION & CONSTRUCTION                 |                                  |      |                 |       |                  |                   |                 |      |  |
|----------------------------------------------------------|----------------------------------|------|-----------------|-------|------------------|-------------------|-----------------|------|--|
| Potential Emissions                                      | Total Emissions (Tons)           |      |                 |       |                  |                   |                 |      |  |
|                                                          | NO <sub>x</sub>                  | VOC  | SO <sub>2</sub> | CO    | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPS |  |
| Preconstruction Potential Emissions - Total              | 6.0                              | 0.4  | 0.0             | 4.1   | 0.3              | 0.3               | 366             | 0.0  |  |
| Inside 25 Miles - Transit                                | 5.8                              | 0.3  | 0.0             | 3.9   | 0.3              | 0.3               | 325             | 0.0  |  |
| Inside 25 Miles - Stationary Sources                     | 0.2                              | 0.1  | 0.0             | 0.2   | 0.0              | 0.0               | 41              | 0.0  |  |
| Construction Potential Emissions - Total                 | 187.2                            | 7.9  | 2.1             | 24.6  | 7.0              | 6.5               | 10,510          | 0.1  |  |
| Inside 25 Miles - Transit                                | 172.6                            | 6.3  | 2.1             | 16.0  | 6.5              | 6.0               | 8,778           | 0.1  |  |
| Inside 25 Miles - Stationary Sources                     | 14.6                             | 1.6  | 0.0             | 8.6   | 0.5              | 0.5               | 1,732           | 0.0  |  |
| Potential Emissions - Total                              | 193.2                            | 8.3  | 2.1             | 28.7  | 7.3              | 6.8               | 10,876          | 0.1  |  |
| Inside 25 Miles - Transit                                | 178.4                            | 6.6  | 2.1             | 19.9  | 6.8              | 6.3               | 9,103           | 0.1  |  |
| Inside 25 Miles - Stationary Sources                     | 14.8                             | 1.7  | 0.0             | 8.8   | 0.5              | 0.5               | 1,773           | 0.0  |  |
| Proposed Annual Emission Limits                          |                                  |      |                 |       |                  |                   |                 |      |  |
| Phase 1 - Year 1 (Preconstruction + 70% Construction)    | 137.04                           | 5.93 | 1.47            | 21.32 | 5.20             | 4.85              | 7,723           | 0.07 |  |
| Phase 1 - Year 2 (30% Construction)                      | 56.16                            | 2.37 | 0.63            | 7.38  | 2.10             | 1.95              | 3,153           | 0.03 |  |
| Emissions Offsets                                        |                                  |      |                 |       |                  |                   |                 |      |  |
| Phase 1 - Year 1 Emissions Offsets (1.26:1 Offset Ratio) | 173                              | 0    | 0               | 0     | 0                | 0                 | 0               | 0    |  |
| Phase 1 - Year 2 Emissions Offsets (1.26:1 Offset Ratio) | 71                               | 0    | 0               | 0     | 0                | 0                 | 0               | 0    |  |
| PHASE 2 - OPERATION                                      |                                  |      |                 |       |                  |                   |                 |      |  |
| Potential Emissions                                      | Annual Emissions (Tons Per Year) |      |                 |       |                  |                   |                 |      |  |
|                                                          | NO <sub>x</sub>                  | VOC  | SO <sub>2</sub> | CO    | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPS |  |
| Potential Emissions - Total                              | 13.0                             | 0.8  | 0.0             | 9.6   | 0.7              | 0.6               | 688             | 0.0  |  |
| Inside 25 Miles - Transit                                | 13.0                             | 0.8  | 0.0             | 9.6   | 0.7              | 0.6               | 688             | 0.0  |  |
| Inside 25 Miles - Stationary Sources                     | 0.0                              | 0.0  | 0.0             | 0.0   | 0.0              | 0.0               | 0               | 0.0  |  |
| Proposed Annual Emission Limits (Note 7)                 |                                  |      |                 |       |                  |                   |                 |      |  |
| Phase 2 - 12-month rolling total                         | 49.9                             | 3.1  | 0.0             | 36.8  | 2.7              | 2.3               | 2,641           | 0.0  |  |

**Notes**

- 1) Project emissions have been estimated using conservative equipment usage assumptions and EPA approved emission factors. The operating hours of all equipment used will be metered to track actual emissions.
- 2) The NO<sub>x</sub>, VOC, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and CO<sub>2</sub> emissions from all vessels equipped with diesel engines have been estimated at the direction of the EPA and MMS using the appropriate emission factors and load factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories, Final Report", April 2009. The HAP emissions from these vessels have been estimated using AP-42 emission factors for diesel engines. The total engine power output estimated for each vessel has been increased by 10% to account for emissions from auxiliary engines.
- 3) The NO<sub>x</sub>, CO, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from all of the stationary nonroad diesel-fired engines to be used for the project have been estimated using the Tier 2 (or Tier 3 if available) emission standards from 40 CFR 89.112, Table 1 for each engine size. Additional CO and PM emissions control will be achieved through the use of diesel oxidation catalysts (DOC) on all project stationary source diesel engines.
- 4) The VOC, SO<sub>2</sub>, CO<sub>2</sub>, and HAP emissions from all of the stationary nonroad diesel-fired engines to be used for the project have been estimated using the appropriate emission factors from EPA's AP-42, "Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources". Additional VOC and HAP emissions control will be achieved through the use of DOC on all project stationary source diesel engines.
- 5) The SO<sub>2</sub> emissions from all of the diesel-fired non-road engines to be used for the project have been estimated assuming a diesel fuel sulfur content of 15 ppm, which will be the fuel sulfur content standard for all nonroad diesel fuel beginning June 1, 2010. The SO<sub>2</sub> emissions from all diesel-fired marine engines used for preconstruction and construction activities have been estimated assuming a diesel fuel sulfur content of 500 ppm, which is the current marine diesel fuel sulfur content standard. The SO<sub>2</sub> emissions from all diesel-fired marine engines used during operation have been estimated assuming a diesel fuel sulfur content of 15 ppm, which will be the marine diesel fuel sulfur content standard beginning June 1, 2012. The EPA's non-road and marine diesel sulfur content standards can be found at 40 CFR 80.510.
- 6) The emissions from the zodiac boats to be used for the project have been estimated using worst-case emission factors from the EPA document: "Exhaust Emission Factors for Nonroad Engine Modeling: Spark-Ignition", EPA420-R-05-019, Table 10.
- 7) The Project will be permitted for up to 49.9 tons per year of NO<sub>x</sub> emissions during Phase 2, to include a contingency for unexpected equipment maintenance and/or repair activities, while remaining a minor source of emissions. The proposed permit limits of the other pollutants have been determined by scaling their individual potential emissions by the ratio of the permitted versus potential NO<sub>x</sub> emissions.

**MEMORANDUM**

TO: Bob McConnell, EPA  
Dirk Herkhof, MMS

DATE: July 30, 2009

FROM: Mike Feinblatt

SUBJECT: Revised Cape Wind Emissions Estimates –  
Methodology

PROJECT NO.: E159-504.1

COPY TO: Chris Rein, ESS  
Rachel Pachter & Craig Olmsted, Cape Wind

ESS Group, Inc. (ESS) has prepared revised emissions estimates for the equipment associated with the construction and operation of the Cape Wind Energy Project. The emission estimates were revised at the direction of the U.S. Environmental Protection Agency (EPA) and the Minerals Management Service (MMS) during the July 16 and July 29, 2009 conference calls regarding the June 2009 emissions estimates for the project.

The emissions from all diesel powered vessels associated with the project have been estimated in accordance with the EPA's "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories – Final Report", April 2009. The emissions estimates have been further revised to address the specific comments made by EPA and MMS during the July 16 and July 29 calls.

The following sections describe the specific revisions made to the June 2009 emissions estimates, at the direction of EPA and MMS.

**Load Factors**

In the June 2009 emissions estimates, reference EPA load factors from Table 3-3 of the EPA Port Study were used for all harbor craft associated with the project. The June 2009 emission estimates utilized a load factor of 0.83 for all ocean going vessels except for tow tugs. A load factor of 0.17 was utilized for ocean going tow tugs, as determined using the Propeller Law.

At the direction of EPA and MMS, Table 3-4 of the EPA Port Study, which presents actual load factors for specified vessels from an emissions inventory conducted at the Port of Los Angeles and Long Beach, has been used for the revised emissions estimates. Table 3-4 recommends a load factor of 0.68 for ocean tugs, which is significantly higher than the 0.17 load factor which had previously been determined using the Propeller Law. This difference is reflective of the fact that a significant percentage of the power of the ocean tug propulsion engine will actually be used to push or pull another vessel, and not for propulsion.

Based on the guidance provided by the EPA Port Study, and at the further direction of EPA and MMS, load factors have been revised and applied to each of the project vessels as follows:

| <b>Vessel Category</b> | <b>Engine Size</b> | <b>Load Factor</b> |
|------------------------|--------------------|--------------------|
| OG Vessels             | >3,000 kW          | 0.83               |
| Crane Barges           | >3,000 kW          | 0.83               |



|              |           |      |
|--------------|-----------|------|
| Ocean Tugs   | >3,000 kW | 0.68 |
| Crew Boats   | <3,000 kW | 0.45 |
| Work Boats   | <3,000 kW | 0.43 |
| Crane Barges | <3,000 kW | 0.43 |
| Tugboats     | <3,000 kW | 0.31 |

#### Auxiliary Engine Emissions

Previous project vessel emissions estimates have not considered emissions from auxiliary engines, because of the uncertainty in the actual vessels to be used, and the level of conservatism built into the emissions estimates. At the direction of EPA and MMS, the project emission estimates have been revised to include the potential for emissions from auxiliary engines on project vessels.

Table 3-10 of the EPA Port Study presents the average number of engines, engine power, and annual operating hours for the main engines and auxiliary engines for different vessel types determined from the Port of Los Angeles, Long Beach, and Puget Sound emissions inventories. According to Table 3-10, the auxiliary engine annual kilowatt-hour power output (number of engines x engine power x annual operating hours) represented approximately 7.9% of the annual main engine power output for work boats, and approximately 7.3%, 5.4%, and 6.8% of the annual main engine power output for assist tugs, harbor tugs, and ocean tugs, respectively.

Based on the information provided in the EPA Port Study, and at the direction of EPA and MMS, each of the project vessel engine kilowatt-hour power outputs, and resulting emissions estimates have been increased by 10%, to conservatively account for emissions from the operation of auxiliary engines on the vessels during project activities.

#### Trip Durations

Previous project vessel emissions estimates have very conservatively estimated the duration of vessel trips to and from the 25-mile boundary, and from the 25-mile boundary to the project site. At the direction of EPA and MMS, the estimates of the duration of such project vessel transit trips have been revised assuming a travel speed of 8 knots, as follows:

| Transit Trip                           | Total Distance | Trip Duration       |
|----------------------------------------|----------------|---------------------|
| Quonset Point to/from 25-mile boundary | 34.9 miles     | 34.9/8 = 4.3625 hrs |
| 25-mile boundary to/from site          | 25 miles       | 25/8 = 3.125 hrs    |
| Quonset Point to/from RI Border        | 19 miles       | 19/8 = 2.375 hrs    |
| MA Border to/from 25-mile boundary     | 7.3 miles      | 7.3/8 = 0.9125 hrs  |

#### Diesel Fuel Sulfur Content

In the previous emissions estimates, the sulfur content of the diesel fuel for all vessels was assumed to be 500 ppm, which is the current sulfur content standard for marine diesel fuel. The sulfur content standard for marine diesel fuel will become 15 ppm beginning June 1, 2012, in accordance with 40 CFR 80.510(c). For this purpose, it is conservatively estimated that construction will be completed by that date; therefore the assumed sulfur content for marine diesel fuel remains 500 ppm for preconstruction and construction vessels. However, in anticipation of the 2012 change in the marine diesel sulfur standard, the assumed sulfur content for marine diesel fuel has been revised to 15 ppm for vessels to be used during operation.

The current sulfur content standard for nonroad diesel fuel is 500 ppm. The sulfur content standard for nonroad diesel fuel will become 15 ppm beginning June 1, 2010, in accordance with 40 CFR 80.510(b). Since construction activities will not be completed by June 1, 2010, the assumed sulfur content for nonroad diesel fuel has been revised to 15 ppm for all stationary sources equipped with diesel engines associated with the project.

#### Conclusion

Attached are the revised versions of the individual spreadsheets that were used to estimate the emissions from the project based on additional direction from MMS and EPA during the July 16 and July 29 conference calls. Also attached is a table summarizing the revised estimated project emissions for all phases and activities. These revised emission estimates for each of the phases and activities associated with the Cape Wind Energy Project have been done on a consistent basis, at the direction of EPA and MMS, using the most up to date EPA guidance for such estimations.

Please review the attached revised estimation of the project emissions, which should now be considered final. Please call me at (781) 489-1149 if you have any questions. Thank you for your assistance in this effort.

**Cape Wind Energy Project**  
**Estimated Project Emissions - Revised July 2009**

| Preconstruction & Construction Emissions                    | Total Emissions (Tons) |             |                 |              |                  |                   |                 |            |
|-------------------------------------------------------------|------------------------|-------------|-----------------|--------------|------------------|-------------------|-----------------|------------|
|                                                             | NO <sub>x</sub>        | VOC         | SO <sub>2</sub> | CO           | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPS       |
| <b>Total</b>                                                | <b>497.1</b>           | <b>28.0</b> | <b>8.1</b>      | <b>133.2</b> | <b>20.2</b>      | <b>18.1</b>       | <b>26,870</b>   | <b>0.3</b> |
| OCS Permit Emissions                                        | 193.2                  | 8.3         | 2.1             | 28.7         | 7.3              | 6.8               | 10,876          | 0.1        |
| Pre-Construction - Inside 25 Miles - Transit                | 5.8                    | 0.3         | 0.0             | 3.9          | 0.3              | 0.3               | 325             | 0.0        |
| Pre-Construction - Inside 25 Miles - Stationary Sources     | 0.2                    | 0.1         | 0.0             | 0.2          | 0.0              | 0.0               | 41              | 0.0        |
| Construction - Inside 25 Miles - Transit                    | 172.6                  | 6.3         | 2.1             | 16.0         | 6.5              | 6.0               | 8,778           | 0.1        |
| Construction - Inside 25 Miles - Stationary Sources         | 14.6                   | 1.6         | 0.0             | 8.6          | 0.5              | 0.5               | 1,732           | 0.0        |
| Year 1 - Preconstruction + 70% Construction                 | 137.04                 | 5.93        | 1.47            | 21.32        | 5.20             | 4.85              | 7,723           | 0.07       |
| Year 2 - 30% Construction                                   | 56.16                  | 2.37        | 0.63            | 7.38         | 2.10             | 1.95              | 3,153           | 0.03       |
| Conformity Emissions                                        | 259.7                  | 18.0        | 5.4             | 100.7        | 11.3             | 9.8               | 13,827          | 0.1        |
| Construction - Onshore Activities - RI                      | 101.3                  | 4.7         | 1.2             | 20.1         | 3.8              | 3.6               | 5,511           | 0.1        |
| Construction - Onshore Activities - MA                      | 23.0                   | 8.2         | 2.1             | 69.4         | 2.7              | 1.8               | 1,689           | 0.0        |
| Construction - Outside 25 Miles - Transit in RI Waters      | 97.8                   | 3.7         | 1.5             | 8.1          | 3.5              | 3.2               | 4,788           | 0.0        |
| Construction - Outside 25 Miles - Transit in MA Waters      | 37.6                   | 1.4         | 0.6             | 3.1          | 1.3              | 1.2               | 1,839           | 0.0        |
| Year 1 - 70% Construction                                   | 181.82                 | 12.59       | 3.78            | 70.47        | 7.89             | 6.83              | 9,679           | 0.07       |
| Year 2 - 30% Construction                                   | 77.92                  | 5.39        | 1.62            | 30.20        | 3.38             | 2.93              | 4,148           | 0.03       |
| Other Emissions                                             |                        |             |                 |              |                  |                   |                 |            |
| Construction - Outside 25 Miles - Transit in Federal Waters | 44.2                   | 1.7         | 0.6             | 3.8          | 1.6              | 1.5               | 2,167           | 0.1        |

| Construction Phase Emissions Offsets Required          | Total ERCs (Tons Per Year) |     |                 |    |                  |                   |                 |      |
|--------------------------------------------------------|----------------------------|-----|-----------------|----|------------------|-------------------|-----------------|------|
|                                                        | NO <sub>x</sub>            | VOC | SO <sub>2</sub> | CO | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPS |
| OCS Permit (1.26:1 Offset Ratio, see Note 12) - Year 1 | 173                        | 0   | 0               | 0  | 0                | 0                 | 0               | 0    |
| OCS Permit (1.26:1 Offset Ratio, see Note 12) - Year 2 | 71                         | 0   | 0               | 0  | 0                | 0                 | 0               | 0    |
| RI Conformity (1:1 Offset Ratio) - Year 1              | 139                        | 0   | 0               | 0  | 0                | 0                 | 0               | 0    |
| RI Conformity (1:1 Offset Ratio) - Year 2              | 60                         | 0   | 0               | 0  | 0                | 0                 | 0               | 0    |
| MA Conformity (1:1 Offset Ratio) - Year 1              | 42                         | 0   | 0               | 0  | 0                | 0                 | 0               | 0    |
| MA Conformity (1:1 Offset Ratio) - Year 2              | 18                         | 0   | 0               | 0  | 0                | 0                 | 0               | 0    |

| Operation Emissions                          | Annual Emissions (Tons Per Year) |            |                 |            |                  |                   |                 |            |
|----------------------------------------------|----------------------------------|------------|-----------------|------------|------------------|-------------------|-----------------|------------|
|                                              | NO <sub>x</sub>                  | VOC        | SO <sub>2</sub> | CO         | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPS       |
| <b>Total</b>                                 | <b>13.3</b>                      | <b>0.8</b> | <b>0.0</b>      | <b>9.6</b> | <b>0.7</b>       | <b>0.6</b>        | <b>704</b>      | <b>0.0</b> |
| OCS Permit Emissions                         | 13.0                             | 0.8        | 0.0             | 9.6        | 0.7              | 0.6               | 688             | 0.0        |
| Inside 25 Miles - Transit                    | 13.0                             | 0.8        | 0.0             | 9.6        | 0.7              | 0.6               | 688             | 0.0        |
| Inside 25 Miles - Stationary Sources         | 0.0                              | 0.0        | 0.0             | 0.0        | 0.0              | 0.0               | 0               | 0.0        |
| Conformity Emissions                         | 0.3                              | 0.0        | 0.0             | 0.0        | 0.0              | 0.0               | 16              | 0.0        |
| Outside 25 Miles - Transit in RI Waters      | 0.0                              | 0.0        | 0.0             | 0.0        | 0.0              | 0.0               | 0               | 0.0        |
| Outside 25 Miles - Transit in MA Waters      | 0.3                              | 0.0        | 0.0             | 0.0        | 0.0              | 0.0               | 16              | 0.0        |
| Other Emissions                              |                                  |            |                 |            |                  |                   |                 |            |
| Outside 25 Miles - Transit in Federal Waters | 0.0                              | 0.0        | 0.0             | 0.0        | 0.0              | 0.0               | 0               | 0.0        |

**Notes**

- 1) Project emissions have been estimated using conservative equipment usage assumptions and EPA approved emission factors. The operating hours of all equipment used will be metered to track actual emissions.
- 2) The NO<sub>x</sub>, VOC, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and CO<sub>2</sub> emissions from all vessels equipped with diesel engines have been estimated at the direction of the EPA and MMS using the appropriate emission factors and load factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories, Final Report", April 2009. The HAP emissions from these vessels have been estimated using AP-42 emission factors for diesel engines. The total engine power output estimated for each vessel has been increased by 10% to account for emissions from auxiliary engines.
- 3) The NO<sub>x</sub>, CO, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from all of the stationary nonroad diesel-fired engines to be used for the project have been estimated using the Tier 2 (or Tier 3 if available) emission standards from 40 CFR 89.112, Table 1 for each engine size. Additional CO and PM emissions control will be achieved through the use of diesel oxidation catalysts (DOC) on all project stationary source diesel engines.
- 4) The VOC, SO<sub>2</sub>, CO<sub>2</sub>, and HAP emissions from all of the stationary nonroad diesel-fired engines to be used for the project have been estimated using the appropriate emission factors from EPA's AP-42, "Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources". Additional VOC and HAP emissions control will be achieved through the use of DOC on all project stationary source diesel engines.
- 5) The SO<sub>2</sub> emissions from all of the diesel-fired non-road engines to be used for the project have been estimated assuming a diesel fuel sulfur content of 15 ppm, which will be the fuel sulfur content standard for all nonroad diesel fuel beginning June 1, 2010. The SO<sub>2</sub> emissions from all diesel-fired marine engines used for preconstruction and construction activities have been estimated assuming a diesel fuel sulfur content of 500 ppm, which is the current marine diesel fuel sulfur content standard. The SO<sub>2</sub> emissions from all diesel-fired marine engines used during operation have been estimated assuming a diesel fuel sulfur content of 15 ppm, which will be the marine diesel fuel sulfur content standard beginning June 1, 2012. The EPA's non-road and marine diesel sulfur content standards can be found at 40 CFR 80.510.
- 6) The emissions from the zodiac boats to be used for the project have been estimated using worst-case emission factors from the EPA document: "Exhaust Emission Factors for Nonroad Engine Modeling: Spark-Ignition", EPA420-R-05-019, Table 10.
- 7) The transit emissions from vessels outside 25 miles have been segregated by jurisdiction by proportioning the estimated total transit time for each vessel based on an average assumed speed of 8 knots and the number of nautical miles traveled within each jurisdiction during each trip.
- 8) All emissions resulting from staging activities in Rhode Island during the construction period have been estimated assuming approximately 8-hours of crane operations required for unloading, staging, and unloading of materials for each vessel trip identified.
- 9) Emissions from onshore construction equipment have been estimated using emission factors from EPA's Nonroad Engine Model Guidance Document, EPA420-P-04-009.
- 10) Emissions from vehicles associated with onshore construction and port activities have been estimated using emission factors from EPA's MOBILE6 Vehicle Model Guidance Document, EPA420-F-05-022.
- 11) Fugitive emissions resulting from onshore construction activities have been estimated using emission factors from the Mid-Atlantic Regional Air Management Association's (MARAMA) Fugitive Dust-Construction Calculation Sheet.
- 12) MassDEP nonattainment rules require an offset ratio of at least 1.2:1. According to Massachusetts ERC Bank Rules, if ERCs are to be used as offsets, an amount of credit equal to five percent more than the amount needed for the offset calculation must be purchased to ensure progress towards attainment, and for the benefit of the environment, resulting in an overall 1.26:1 offset ratio.
- 13) Emissions from onshore activities in RI include an estimate of emissions from ship deliveries of parts and materials to the port at Quonset Point. It has been assumed that all parts and materials will be transported to the port by ship for this analysis.



Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories," April 2009

| Emission Factors - Ocean Going Vessel Main Engine, Medium-Speed Diesel, Marine Diesel Oil, g/KWh (Table 2-3) |          |                 |                 |                  |                   |                   |                 |         |  |
|--------------------------------------------------------------------------------------------------------------|----------|-----------------|-----------------|------------------|-------------------|-------------------|-----------------|---------|--|
| Engine                                                                                                       | NOx      | VOC (HC)        | SO <sub>2</sub> | CO               | PM <sub>10</sub>  | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| MSD & MDO                                                                                                    | 13.2     | 0.30            | 0.20            | 1.10             | 0.47              | 0.43              | 646.08          | 0.00635 |  |
| Emission Factors - Harbor Craft, Tier 0, g/KWh (Table 3-8)                                                   |          |                 |                 |                  |                   |                   |                 |         |  |
| Engine Power                                                                                                 | NOx (HC) | SO <sub>2</sub> | CO              | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub>   | HAPs            |         |  |
| 225 - 449 kW (Cat. 1)                                                                                        | 10.0     | 0.27            | 0.043           | 1.50             | 0.30              | 0.29              | 690.00          | 0.0161  |  |
| 450 - 699 kW (Cat. 1)                                                                                        | 10.0     | 0.27            | 0.043           | 1.50             | 0.30              | 0.29              | 690.00          | 0.0161  |  |
| 700 - 999 kW (Cat. 1)                                                                                        | 10.0     | 0.27            | 0.043           | 1.50             | 0.30              | 0.29              | 690.00          | 0.0161  |  |
| 1,000 - 1,999 kW (Cat. 1)                                                                                    | 13.0     | 0.27            | 0.043           | 2.50             | 0.30              | 0.29              | 690.00          | 0.00635 |  |
| 2,000 - 3,000 kW (Cat. 2)                                                                                    | 13.2     | 0.30            | 0.043           | 1.10             | 0.72              | 0.70              | 690.00          | 0.00635 |  |

Category 2 vessels are defined by EPA as smaller harbor craft and recreational propulsion (&lt;1,000 kW).

Category 3 vessels are defined by EPA as OSV auxiliary engines, harbor craft, and smaller OSV propulsion (1,000-3,000 kW).

HAP emission factors are from AP-42 (Sections 3.3 &amp; 3.4).

Load Factors are from Table 3-4 of the EPA Port Emissions Guidance Document.

Emission Factors (g/hr-hr) Diesel Recip. &lt;600 hp Based on AP-42 Vol.1, Table 3.3.1 - 3.3.2

| Emission Factors (g/hr-hr) Diesel Recip. <600 hp Based on AP-42 Vol.1, Table 3.3.1 - 3.3.2 |     |      |                 |      |                  |                   |                 |       |  |
|--------------------------------------------------------------------------------------------|-----|------|-----------------|------|------------------|-------------------|-----------------|-------|--|
| Engine Size                                                                                | NOx | VOC  | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs  |  |
| 225 kW <450                                                                                | 4.0 | 1.14 | 0.01            | 0.01 | 0.01             | 0.01              | 521.63          | 0.012 |  |
|                                                                                            |     |      |                 |      |                  |                   |                 |       |  |
|                                                                                            |     |      |                 |      |                  |                   |                 |       |  |

\* EPA emission standard is for NOx+THC. It has been assumed that all emissions are NOx to be conservative.

Emission Factors (lb/MMBtu) Natural Gas 4-Stroke Based on AP-42 Vol.1, Table 3.2-2

| Emission Factors (lb/MMBtu) Natural Gas 4-Stroke Based on AP-42 Vol.1, Table 3.2-2 |      |         |                 |         |                  |                   |                 |         |  |
|------------------------------------------------------------------------------------|------|---------|-----------------|---------|------------------|-------------------|-----------------|---------|--|
| Engine                                                                             | NOx  | VOC     | SO <sub>2</sub> | CO      | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| Gas Fired                                                                          | 0.85 | 0.00077 | 0.00000         | 0.00000 | 0.00000          | 0.00000           | 0.00000         | 0.00000 |  |
| Gas Fired                                                                          | 0.85 | 0.00077 | 0.00000         | 0.00000 | 0.00000          | 0.00000           | 0.00000         | 0.00000 |  |
| Gas Fired                                                                          | 0.85 | 0.00077 | 0.00000         | 0.00000 | 0.00000          | 0.00000           | 0.00000         | 0.00000 |  |

Nonroad Engine Modeling: Spark-Ignition, EPA20-R-05-019, Table 10. Worst case emission factors were selected from carbureted, indirect injection and direct injection engine types. When calculating emissions, HC and PM were equated with VOC and PM10, respectively.

| Activity Type                                                      | Vessel Type / Emission Source | Number of Sources | Equipment Size (HP) | Equipment Size (kW) | Activity                                               | Count   | Duration   | Operating Hours (per unit) | Assumptions                                                                                   | Load Factor | Auxiliary Engine Power Adjustment | NOx   | VOC   | SO <sub>2</sub> | CO    | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs  |
|--------------------------------------------------------------------|-------------------------------|-------------------|---------------------|---------------------|--------------------------------------------------------|---------|------------|----------------------------|-----------------------------------------------------------------------------------------------|-------------|-----------------------------------|-------|-------|-----------------|-------|------------------|-------------------|-----------------|-------|
| Preconstruction Period - Activities within 25 Miles of the Project |                               |                   |                     |                     |                                                        |         |            |                            |                                                                                               |             |                                   |       |       |                 |       |                  |                   |                 |       |
| Geophysical - WTG's                                                | 42' Diesel Lobster Boat       | 1                 | 1,000               | 746                 | -Travel b/w Fairmouth and WP<br>- 30 miles of transect | 6 days  | 10 hrs/day | 60                         | - 2 hrs. @ 15 knots then 8 hrs. @ 3 knots                                                     | 0.43        | 1.100                             | 0.2   | 0.0   | 0.0             | 0.0   | 0.0              | 0.0               | 16.1            | 0.0   |
| Geophysical - 33 kV Inner Array Cable                              | 42' Diesel Lobster Boat       | 1                 | 1,000               | 746                 | -Travel b/w Fairmouth and WP<br>- 30 miles of transect | 20 days | 10 hrs/day | 200                        | - 2 hrs. @ 15 knots then 8 hrs. @ 3 knots                                                     | 0.43        | 1.100                             | 0.8   | 0.0   | 0.0             | 0.1   | 0.0              | 0.0               | 53.6            | 0.0   |
| Geophysical - 115 kV Interconnect Cable                            | 42' Diesel Lobster Boat       | 1                 | 1,000               | 746                 | -Travel b/w Fairmouth and WP<br>- 30 miles of transect | 7 days  | 10 hrs/day | 70                         | - 2 hrs. @ 15 knots then 8 hrs. @ 3 knots                                                     | 0.43        | 1.100                             | 0.3   | 0.0   | 0.0             | 0.0   | 0.0              | 0.0               | 18.9            | 0.0   |
| Electrical Generator                                               | Gas Fired                     | 1                 | 8.7                 | 6.5                 |                                                        | 30 days | 10 hrs/day | 300                        |                                                                                               |             |                                   | 0.008 | 0.001 | 0.000           | 0.005 | 0.000            | 0.000             | 1.007           | 0.001 |
| Borings                                                            | Tug Boat                      | 1                 | 1,500               | 1,119               | Travel b/w Fairmouth and WP                            | 30 days | 24 hrs/day | 720                        | Full Load @ 1 hr/day                                                                          | 0.31        | 1.100                             | 4.0   | 0.3   | 0.0             | 0.3   | 0.2              | 0.2               | 208.7           | 0.0   |
| Boring Drill Rig                                                   | Truck-mtl Rig                 | 1                 | 350                 | 261                 | 1 boring/day                                           | 20 days | 10 hr/day  | 200                        | Rig Stays on HSS till done                                                                    |             |                                   | 0.2   | 0.1   | 0.0             | 0.2   | 0.0              | 0.0               | 40.2            | 0.0   |
| Vibracore Boat                                                     |                               |                   |                     |                     | Final Cable Design and Constructability survey         | 8 days  | 10 hr/day  | 80                         | - 33 kV: 1 core/3 miles of cable, total 22<br>- 115 kV: 2 miles of cable, total 28<br>- 6 day | 0.43        | 1.100                             | 0.3   | 0.0   | 0.0             | 0.0   | 0.0              | 0.0               | 21.4            | 0.0   |
| Multibeam Survey                                                   | 26' Boat                      | 1                 | 300                 | 224                 | Shallow area survey                                    | 8 days  | 10 hr/day  | 80                         |                                                                                               | 0.43        | 1.100                             | 0.1   | 0.0   | 0.0             | 0.0   | 0.0              | 0.0               | 6.4             | 0.0   |
| Electrical Generator                                               | Gas Fired                     | 1                 | 4                   | 3                   |                                                        | 8 days  | 10 hr/day  | 80                         |                                                                                               |             |                                   | 0.001 | 0.000 | 0.000           | 0.000 | 0.000            | 0.000             | 0.124           | 0.000 |
| Crew Movement                                                      | Zodiac Boat                   | 1                 | 100                 | 75                  | 1 boring/day                                           | 20 days | 10 hr/day  | 200                        | Zodiac only needed for boring program                                                         |             |                                   | 0.1   | 0.1   | 0.1             | 0.4   | 0.001            | 0.001             | 3.4             | 0.001 |
| Preconstruction Emissions - Stationary Sources                     |                               |                   |                     |                     |                                                        |         |            |                            |                                                                                               |             |                                   |       |       |                 |       |                  |                   |                 |       |
| Preconstruction Emissions - Transit                                |                               |                   |                     |                     |                                                        |         |            |                            |                                                                                               |             |                                   |       |       |                 |       |                  |                   |                 |       |
| Total Preconstruction Emissions                                    |                               |                   |                     |                     |                                                        |         |            |                            |                                                                                               |             |                                   |       |       |                 |       |                  |                   |                 |       |
|                                                                    |                               |                   |                     |                     |                                                        |         |            |                            |                                                                                               |             |                                   | 0.2   | 0.1   | 0.0             | 0.2   | 0.0              | 0.0               | 41              | 0.0   |
|                                                                    |                               |                   |                     |                     |                                                        |         |            |                            |                                                                                               |             |                                   | 5.8   | 0.3   | 0.0             | 3.9   | 0.3              | 0.3               | 325             | 0.0   |
|                                                                    |                               |                   |                     |                     |                                                        |         |            |                            |                                                                                               |             |                                   | 6.0   | 0.4   | 0.0             | 4.1   | 0.3              | 0.3               | 366             | 0.0   |

All operating hours will be metered to track actual emissions.

Diesel Fuel Sulfur Content: 500 ppm

Diesel Fuel Sulfur Content: 15 ppm

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

Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009

| Emission Factors - Ocean Going Vessel Main Engines, Medium-Speed Diesel, Marine Diesel Oil, g/kWh (Table 2-9) |      |          |                 |      |                  |                   |                 |         |  |
|---------------------------------------------------------------------------------------------------------------|------|----------|-----------------|------|------------------|-------------------|-----------------|---------|--|
| Engine                                                                                                        | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| MSD & MDO                                                                                                     | 13.2 | 0.50     | 0.20            | 1.10 | 0.47             | 0.43              | 646.08          | 0.00635 |  |
| Emission Factors - Harbor Craft, Tier 0, g/kWh (Table 3-8)                                                    |      |          |                 |      |                  |                   |                 |         |  |
| Engine Power                                                                                                  | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| 225 - 448 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |  |
| 450 - 558 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |  |
| 560 - 899 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.00635 |  |
| 1,000 - 1,300 kW (Cat. 1)                                                                                     | 13.0 | 0.27     | 0.043           | 2.50 | 0.30             | 0.29              | 690.00          | 0.00635 |  |
| 1,000 - 3,000 kW (Cat. 2)                                                                                     | 13.2 | 0.50     | 0.043           | 1.10 | 0.72             | 0.70              | 690.00          | 0.00635 |  |

Category 1 vessels are defined by EPA as small harbor craft and recreational population (&lt;1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (&lt;3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (&gt;3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 &amp; 3.4)

Ocean Going Vessel Load Factors were assumed to be 0.83, consistent with Section 2.5 of the EPA Port Emissions Guidance Document.

Harbor Craft Load Factors are from Table 3.4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

| Activity Type                                                           |  | Vessel Type/<br>Emission Source |  | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                           | Count     | Duration   | Operating<br>Hours<br>(per unit) | Assumptions                                                     | Travel Origin beyond<br>25 Mile Radius | Load Factor | Auxiliary Engine<br>Power Adjustment | Emissions (tons) |       |                 |     |                  |                   |                 |        |     |     |    |     |  |  |
|-------------------------------------------------------------------------|--|---------------------------------|--|----------------------|------------------------|------------------------|------------------------------------|-----------|------------|----------------------------------|-----------------------------------------------------------------|----------------------------------------|-------------|--------------------------------------|------------------|-------|-----------------|-----|------------------|-------------------|-----------------|--------|-----|-----|----|-----|--|--|
|                                                                         |  |                                 |  |                      |                        |                        |                                    |           |            |                                  |                                                                 |                                        |             |                                      | NOx              | VOC   | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs   |     |     |    |     |  |  |
| Construction Period - Transit Activities within 25 Miles of the Project |  |                                 |  |                      |                        |                        |                                    |           |            |                                  |                                                                 |                                        |             |                                      |                  |       |                 |     |                  |                   |                 |        |     |     |    |     |  |  |
| Pile Installation                                                       |  |                                 |  |                      |                        |                        |                                    |           |            |                                  |                                                                 |                                        |             |                                      |                  |       |                 |     |                  |                   |                 |        |     |     |    |     |  |  |
| Move jack up barge to Wind Park                                         |  | attendant tug                   |  | 1                    | 3,000                  | 2,237                  | Travel b/w 25-mile boundary and WP | 4 trips   | 3          | 13                               | This is done twice (once per year)                              | Quonset Point, RI                      | 0.31        | 1.100                                |                  | 0.1   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 0.0    | 0.0 | 0.0 | 72 | 0.0 |  |  |
| Transport piles and transition pieces to wind park                      |  | tow tug                         |  | 1                    | 6,000                  | 4,474                  | Travel b/w 25-mile boundary and WP | 86 trips  | 3          | 269                              | avg. 3 piles per trip, 130 piles, duration only w/in 25 miles   | Quonset Point, RI                      | 0.68        | 1.100                                |                  | 13.1  | 0.5             | 0.2 | 1.1              | 0.5               | 0.4             | 640.0  | 0.0 |     |    |     |  |  |
| Pile barge handling tug @ Wind Park                                     |  | attendant tug                   |  | 1                    | 3,000                  | 2,237                  | Daily activity                     | 130 days  | 3 hrs/day  | 390                              | 3 piles per week, attendant tugs only operate equiv of 1/2 day  |                                        | 0.31        | 1.100                                |                  | 4.3   | 0.2             | 0.0 | 0.4              | 0.2               | 0.2             | 226.1  | 0.0 |     |    |     |  |  |
| Moving crew in and out                                                  |  | crew boats                      |  | 2                    | 750                    | 559                    | daily travel b/w Fairmouth and WP  | 130 days  | 1          | 182                              |                                                                 |                                        | 0.45        | 1.100                                |                  | 11.1  | 0.0             | 0.0 | 0.2              | 0.0               | 0.0             | 76.4   | 0.0 |     |    |     |  |  |
| Transition piece handling tugs @ Wind Park                              |  | attendant tug                   |  | 1                    | 3,000                  | 2,237                  | Daily activity                     | 130 days  | 4 hrs/day  | 520                              | 3 pieces per week, attendant tugs only operate equiv of 1/2 day |                                        | 0.31        | 1.100                                |                  | 5.8   | 0.2             | 0.0 | 0.5              | 0.3               | 0.3             | 301.4  | 0.0 |     |    |     |  |  |
| Installation of scour protection                                        |  | attendant tug                   |  | 1                    | 3,000                  | 2,237                  | Travel b/w 25-mile boundary and WP | 4 trips   | 3          | 13                               | This is done twice (once per year)                              | Quonset Point, RI                      | 0.31        | 1.100                                |                  | 0.1   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 72     | 0.0 |     |    |     |  |  |
| Move scour protection installation equipment to Wind Park               |  | tow tug                         |  | 1                    | 6,000                  | 4,474                  | Travel b/w 25-mile boundary and WP | 276 trips | 3          | 863                              | Spd. 8 knts                                                     | Quonset Point, RI                      | 0.68        | 1.100                                |                  | 42.0  | 1.6             | 0.6 | 3.5              | 1.5               | 1.4             | 2053.9 | 0.0 |     |    |     |  |  |
| Transport rock armor barges                                             |  | tow tug                         |  | 1                    | 6,000                  | 4,474                  | Travel b/w 25-mile boundary and WP | 370 trips | 3          | 1,156                            | Spd. 8 knts                                                     | Quonset Point, RI                      | 0.68        | 1.100                                |                  | 56.3  | 2.1             | 0.8 | 4.7              | 2.0               | 1.8             | 2753.4 | 0.0 |     |    |     |  |  |
| Transport filler material barges                                        |  | tow tug                         |  | 1                    | 6,000                  | 4,474                  | Travel b/w 25-mile boundary and WP | 130 days  | 4 hrs/day  | 520                              |                                                                 |                                        | 0.31        | 1.100                                |                  | 11.5  | 0.4             | 0.0 | 1.0              | 0.6               | 0.6             | 602.9  | 0.0 |     |    |     |  |  |
| Armor/filler barge handling tugs @ Wind Park                            |  | attendant tugs                  |  | 2                    | 3,000                  | 2,237                  | Daily activity                     |           |            |                                  |                                                                 |                                        |             |                                      |                  | 134.3 | 5.1             | 1.8 | 11.3             | 5.2               | 4.8             | 6,669  | 0.1 |     |    |     |  |  |
| Subtotal                                                                |  |                                 |  |                      |                        |                        |                                    |           |            |                                  |                                                                 |                                        |             |                                      |                  |       |                 |     |                  |                   |                 |        |     |     |    |     |  |  |
| Cable laying                                                            |  |                                 |  |                      |                        |                        |                                    |           |            |                                  |                                                                 |                                        |             |                                      |                  |       |                 |     |                  |                   |                 |        |     |     |    |     |  |  |
| 115 kV Cable laying barge to wind farm                                  |  | tow tug                         |  | 1                    | 1,500                  | 1,119                  | Travel b/w 25-mile boundary and WP | 4 trips   | 3          | 13                               |                                                                 | Quonset Point, RI                      | 0.31        | 1.100                                |                  | 0.1   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 3.6    | 0.0 |     |    |     |  |  |
| Put cable in place                                                      |  | crane barge                     |  | 1                    | 400                    | 298                    |                                    | 15 days   | 10 hrs/day | 150                              | 10 hrs/day for 15 work days                                     |                                        | 0.43        | 1.100                                |                  | 0.2   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 16.1   | 0.0 |     |    |     |  |  |
| Put cable in place                                                      |  | attendant tug                   |  | 1                    | 1,500                  | 1,119                  |                                    | 15 days   | 10 hrs/day | 150                              | 10 hrs/day for 15 work days                                     |                                        | 0.31        | 1.100                                |                  | 0.8   | 0.0             | 0.0 | 0.2              | 0.0               | 0.0             | 43.5   | 0.0 |     |    |     |  |  |
| Put cable in place                                                      |  | anchoring tug                   |  | 1                    | 4,000                  | 2,983                  |                                    | 15 days   | 10 hrs/day | 150                              | 10 hrs/day for 15 work days                                     |                                        | 0.31        | 1.100                                |                  | 2.2   | 0.1             | 0.0 | 0.2              | 0.1               | 0.1             | 115.9  | 0.0 |     |    |     |  |  |
| Moving crew in and out                                                  |  | crew boats                      |  | 1                    | 750                    | 559                    |                                    | 15 days   | 2 hrs/day  | 30                               |                                                                 |                                        | 0.45        | 1.100                                |                  | 0.1   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 6.3    | 0.0 |     |    |     |  |  |
| 33 kV Cable laying barge to wind farm                                   |  | tow tug                         |  | 1                    | 1,500                  | 1,119                  | Travel b/w 25-mile boundary and WP | 26 trips  | 3          | 81                               | 13 round trips                                                  | Quonset Point, RI                      | 0.31        | 1.100                                |                  | 0.4   | 0.0             | 0.0 | 0.1              | 0.0               | 0.0             | 23.6   | 0.0 |     |    |     |  |  |
| Put cable in place                                                      |  | crane barge                     |  | 1                    | 400                    | 298                    |                                    | 130 days  | 10 hrs/day | 1300                             | 10 hrs/day for 10 work days/strip - 13 strips                   |                                        | 0.43        | 1.100                                |                  | 2.0   | 0.1             | 0.0 | 0.3              | 0.1               | 0.1             | 139.4  | 0.0 |     |    |     |  |  |

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

Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009

Emission Factors - Ocean Going Vessel Main Engines, Medium-Speed Diesel, Marine Diesel Oil, g/kWh (Table 2-3)

| Engine                                                            | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |
|-------------------------------------------------------------------|------|----------|-----------------|------|------------------|-------------------|-----------------|---------|
| MSD & MDO                                                         | 73.2 | 0.50     | 0.20            | 1.10 | 0.47             | 0.43              | 646.08          | 0.00635 |
| <b>Emission Factors - Harbor Craft, Tier 0, g/kWh (Table 3-8)</b> |      |          |                 |      |                  |                   |                 |         |
| Engine Power                                                      | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |
| 225 - 449 kW (Cat. 1)                                             | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |
| 450 - 559 kW (Cat. 1)                                             | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |
| 560 - 899 kW (Cat. 1)                                             | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.00635 |
| 1,000 kW (Cat. 1)                                                 | 13.0 | 0.27     | 0.043           | 2.50 | 0.30             | 0.29              | 690.00          | 0.00635 |
| 1,000 - 3,000 kW (Cat. 2)                                         | 13.0 | 0.50     | 0.043           | 1.10 | 0.72             | 0.70              | 690.00          | 0.00635 |

Category 1 vessels are defined by EPA as small harbor craft and recreational population (&lt;1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (1,000-3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (&gt;3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 &amp; 3.4)

Ocean Going Vessel Load Factors were assumed to be 0.83, consistent with Section 2.5 of the EPA Port Emissions Guidance Document.

Harbor Craft Load Factors are from Table 3-4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

| Activity Type                          | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                                  | Count     | Duration   | Operating<br>Hours<br>(per unit) | Assumptions                                        | Travel Origin beyond<br>25 Mile Radius | Load Factor | Auxiliary Engine<br>Power Adjustment | NOx   | VOC | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs |
|----------------------------------------|---------------------------------|----------------------|------------------------|------------------------|-------------------------------------------|-----------|------------|----------------------------------|----------------------------------------------------|----------------------------------------|-------------|--------------------------------------|-------|-----|-----------------|------|------------------|-------------------|-----------------|------|
| Put cable in place                     | attendant tug                   | 1                    | 1,500                  | 1,119                  |                                           | 130 days  | 10 hrs/day | 1300                             | 10 hrs/day for 10 work<br>days/string - 13 strings |                                        | 0.31        | 1.100                                | 7.1   | 0.1 | 0.0             | 1.4  | 0.2              | 0.2               | 376.8           | 0.0  |
| Move Crane barge to cofferdam location | tow tug                         | 1                    | 1,500                  | 1,119                  | Travel b/w 25-<br>mile boundary<br>and WP | 4 trips   | 3          | 13                               |                                                    | Quonset Point, RI                      | 0.31        | 1.100                                | 0.1   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 3.6             | 0.0  |
| HDD Cofferdam Excavation               | crane barge                     | 1                    | 400                    | 298                    | Excavation                                | 2 days    | 10 hrs/day | 20                               | 2 day @10 hrs/day - Spd. ~<br>12 knots             |                                        | 0.43        | 1.100                                | 0.0   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 2.1             | 0.0  |
| Moving crew in and out                 | crew boat                       | 1                    | 750                    | 559                    |                                           | 10 days   | 2 hrs/day  | 20                               | 1hr each way per crew boat                         |                                        | 0.45        | 1.100                                | 0.1   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 4.2             | 0.0  |
| <b>Subtotal</b>                        |                                 |                      |                        |                        |                                           |           |            |                                  |                                                    |                                        |             |                                      | 13.2  | 0.3 | 0.0             | 2.2  | 0.4              | 0.4               | 735             | 0.0  |
| Turbine Installation                   | one specialized vessel          | 1                    | 6,000                  | 4,474                  | Travel b/w 25-<br>mile boundary<br>and WP | 86 trips  | 3          | 269                              | Only emissions within 25<br>miles of Wind Park     | Quonset Point, RI                      | 0.83        | 1.100                                | 16.0  | 0.6 | 0.2             | 1.3  | 0.6              | 0.5               | 781.2           | 0.0  |
| Moving crew in and out                 | crew boats                      | 4                    | 750                    | 559                    |                                           | 130 days  | 2 hrs/day  | 260                              | 2 days per WTG                                     |                                        | 0.45        | 1.100                                | 3.2   | 0.1 | 0.0             | 0.5  | 0.1              | 0.1               | 248.8           | 0.0  |
| <b>Subtotal</b>                        |                                 |                      |                        |                        |                                           |           |            |                                  |                                                    |                                        |             |                                      | 19.1  | 0.7 | 0.3             | 1.8  | 0.7              | 0.6               | 1,000           | 0.0  |
| ESP Installation                       | tow tug                         | 1                    | 3,000                  | 2,237                  | Travel b/w 25-<br>mile boundary<br>and WP | 2 trips   | 3          | 6                                |                                                    | Quonset Point, RI                      | 0.31        | 1.100                                | 0.1   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 3.6             | 0.0  |
| Handling crane barge                   | attendant tug                   | 1                    | 3,000                  | 2,237                  | Travel b/w 25-<br>mile boundary<br>and WP | 1         | 16 hrs.    | 20                               | 4 hrs. transit and 16 hrs. on<br>site              |                                        | 0.31        | 1.100                                | 0.2   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 11.6            | 0.0  |
| Pile Installation barge towing         | tow tug                         | 1                    | 3,000                  | 2,237                  | Travel b/w 25-<br>mile boundary<br>and WP | 2 trips   | 3          | 6                                |                                                    | Quonset Point, RI                      | 0.31        | 1.100                                | 0.1   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 3.6             | 0.0  |
| Handling barge                         | attendant tug                   | 1                    | 3,000                  | 2,237                  |                                           | 6         | 3 hrs.     | 18                               |                                                    |                                        | 0.31        | 1.100                                | 0.2   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 10.4            | 0.0  |
| ESP deck to wind farm                  | tow tug                         | 1                    | 6,000                  | 4,474                  | Travel b/w 25-<br>mile boundary<br>and WP | 2 trips   | 3          | 6                                |                                                    | Quonset Point, RI                      | 0.68        | 1.100                                | 0.3   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 14.9            | 0.0  |
| Crane barge towing                     | tow tug                         | 1                    | 3,000                  | 2,237                  | Travel b/w 25-<br>mile boundary<br>and WP | 2 trips   | 3          | 6                                |                                                    | Quonset Point, RI                      | 0.31        | 1.100                                | 0.1   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 3.6             | 0.0  |
| Setting the deck for ESP Installation  | crane barge                     | 1                    | 6,000                  | 4,474                  |                                           | 1         | 16 hrs.    | 16                               |                                                    |                                        | 0.83        | 1.100                                | 1.0   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 46.5            | 0.0  |
| Handling crane barge                   | attendant tug                   | 1                    | 3,000                  | 2,237                  |                                           | 2 trips   | 9 hrs/trip | 18                               | 12 hrs. out, 6 hours back                          |                                        | 0.31        | 1.100                                | 0.2   | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 10.4            | 0.0  |
| Moving crew in and out                 | crew boats                      | 4                    | 750                    | 559                    |                                           | 160 trips | 2 hrs/trip | 320                              | 40 days, 2 RT/day - 2<br>hrs each way              |                                        | 0.45        | 1.100                                | 3.9   | 0.1 | 0.0             | 0.6  | 0.1              | 0.1               | 269.3           | 0.0  |
| <b>Subtotal</b>                        |                                 |                      |                        |                        |                                           |           |            |                                  |                                                    |                                        |             |                                      | 6.0   | 0.2 | 0.0             | 0.8  | 0.2              | 0.2               | 374             | 0.0  |
| <b>TOTAL Construction Emissions</b>    |                                 |                      |                        |                        |                                           |           |            |                                  |                                                    |                                        |             |                                      | 172.6 | 6.3 | 2.1             | 16.0 | 6.5              | 6.0               | 8,778           | 0.1  |

Duration

Over 1 to 2-Year Construction

A vessel speed of 8 knots was assumed to determine the duration for each trip

All operating hours will be metered to track actual emissions.

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                                                            |       |                 |     |                  |                   |                 |         | Diesel Fuel Sulfur Content: 15 ppm |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------|-----|------------------|-------------------|-----------------|---------|------------------------------------|
| NOx                                                                                                                                                     | VOC   | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |                                    |
|                                                                                                                                                         | 0.33  | 0.01            |     |                  |                   | 526.16          | 0.00474 |                                    |
| Emission Factors (g /hp-hr) Diesel Recip. <600 hp Based on AP-42 Vol.1, Tables 3.3-1 - 3.3-2                                                            |       |                 |     |                  |                   |                 |         |                                    |
| NOx                                                                                                                                                     | TOC*  | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |                                    |
|                                                                                                                                                         | 1.14  | 0.01            |     |                  |                   | 521.63          | 0.012   |                                    |
| * Emission factor for VOC was not available; TOC emission factor is used instead, which will result in a very conservative estimation of VOC emissions. |       |                 |     |                  |                   |                 |         |                                    |
| EPA Nonroad Diesel Engine Emission Standard (Tier 2 or Tier 3 if available), g/KW-hr                                                                    |       |                 |     |                  |                   |                 |         |                                    |
| Engine Size                                                                                                                                             | NOx * | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |                                    |
| 75≤kW<130                                                                                                                                               | 4.0   |                 | 5.0 | 0.30             | 0.30              |                 |         |                                    |
| 225≤kW<450                                                                                                                                              | 4.0   |                 | 3.5 | 0.20             | 0.20              |                 |         |                                    |
| kW>560                                                                                                                                                  | 6.4   |                 | 3.5 | 0.20             | 0.20              |                 |         |                                    |

\* EPA emission standard is for NOx+NMHC. It has been assumed that all emissions are NOx to be conservative.

| Activity Type                                                              | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity       | Count     | Duration   | Operating<br>Hours<br>(per unit) | Assumptions            | Emissions (tons) |     |                 |     |                  |                   |                 |      |
|----------------------------------------------------------------------------|---------------------------------|----------------------|------------------------|------------------------|----------------|-----------|------------|----------------------------------|------------------------|------------------|-----|-----------------|-----|------------------|-------------------|-----------------|------|
|                                                                            |                                 |                      |                        |                        |                |           |            |                                  |                        | NOx              | VOC | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs |
| Construction Period - Stationary Activities within 25 Miles of the Project |                                 |                      |                        |                        |                |           |            |                                  |                        |                  |     |                 |     |                  |                   |                 |      |
| Pile Installation                                                          |                                 |                      |                        |                        |                |           |            |                                  |                        |                  |     |                 |     |                  |                   |                 |      |
| Put piles in place                                                         | primary 500 ton crane           | 1                    | 800                    | 597                    | Set piles      | 130 days  | 4 hrs/day  | 520                              |                        | 2.2              | 0.2 | 0.0             | 1.2 | 0.1              | 0.1               | 241.1           | 0.0  |
| Pile driving                                                               | Hydraulic ram                   | 1                    | 1,600                  | 1,193                  | Set piles      | 130 piles | 4 hrs/pile | 520                              | IHC S-1200 hydrohammer | 4.4              | 0.3 | 0.0             | 2.4 | 0.1              | 0.1               | 482.1           | 0.0  |
| Set transition pieces                                                      | primary 500 ton crane           | 1                    | 800                    | 597                    | Set Pieces     | 130 days  | 4 hrs/day  | 520                              |                        | 2.2              | 0.2 | 0.0             | 1.2 | 0.1              | 0.1               | 241.1           | 0.0  |
| Installation of scour protection                                           |                                 |                      |                        |                        |                |           |            |                                  |                        |                  |     |                 |     |                  |                   |                 |      |
| Install rock armor                                                         | crane                           | 1                    | 400                    | 298                    | Daily activity | 65 days   | 8 hrs/day  | 520                              | 2 towers per day       | 0.7              | 0.3 | 0.0             | 0.6 | 0.0              | 0.0               | 0.0             | 0.0  |
| Install filler material                                                    | crane                           | 1                    | 400                    | 298                    | Daily activity | 65 days   | 8 hrs/day  | 520                              | 2 towers per day       | 0.7              | 0.3 | 0.0             | 0.6 | 0.0              | 0.0               | 119.5           | 0.0  |
| Subtotal                                                                   |                                 |                      |                        |                        |                |           |            |                                  |                        | 10.1             | 1.1 | 0.0             | 6.0 | 0.3              | 0.3               | 1,203           | 0.0  |
| Cable laying                                                               |                                 |                      |                        |                        |                |           |            |                                  |                        |                  |     |                 |     |                  |                   |                 |      |
| Sheet Pile Driving for cofferdam                                           |                                 | 1                    | 400                    | 298                    |                | 2 days    | 10 hrs/day | 20                               | 2 day @10 hrs/day      | 0.0              | 0.0 | 0.0             | 0.0 | 0.0              | 0.0               | 4.6             | 0.0  |
| Compressor Drive                                                           |                                 | 1                    | 100                    | 75                     |                | 2 days    | 8 hrs/day  | 16                               | 2 day @8 hrs/day       | 0.0              | 0.0 | 0.0             | 0.0 | 0.0              | 0.0               | 0.9             | 0.0  |
| Sheet Pile Removal                                                         |                                 | 1                    | 400                    | 298                    |                | 2 days    | 10 hrs/day | 20                               | 2 day @10 hrs/day      | 0.0              | 0.0 | 0.0             | 0.0 | 0.0              | 0.0               | 4.6             | 0.0  |
| Cofferdam Backfill                                                         | crane barge                     | 1                    | 400                    | 298                    | Backfill       | 2 days    | 10 hrs/day | 20                               | 2 day @10 hrs/day      | 0.0              | 0.0 | 0.0             | 0.0 | 0.0              | 0.0               | 4.6             | 0.0  |
| Subtotal                                                                   |                                 |                      |                        |                        |                |           |            |                                  |                        | 0.1              | 0.0 | 0.0             | 0.1 | 0.0              | 0.0               | 15              | 0.0  |
| Turbine Installation                                                       |                                 |                      |                        |                        |                |           |            |                                  |                        |                  |     |                 |     |                  |                   |                 |      |
| Stabilizing the the WTG vessel in correct location and elevation           | jacking system with 6 legs      | 1                    | 476                    | 355                    |                | 130 days  | 2 hrs/day  | 260                              |                        | 0.4              | 0.2 | 0.0             | 0.4 | 0.0              | 0.0               | 71.1            | 0.0  |
| Tower Installation                                                         | primary 500 ton crane           | 1                    | 800                    | 597                    |                | 130 days  | 2 hrs/day  | 260                              |                        | 1.1              | 0.1 | 0.0             | 0.6 | 0.0              | 0.0               | 120.5           | 0.0  |
| Nacelle installation                                                       | primary 500 ton crane           | 1                    | 800                    | 597                    |                | 130 days  | 2 hrs/day  | 260                              |                        | 1.1              | 0.1 | 0.0             | 0.6 | 0.0              | 0.0               | 120.5           | 0.0  |
| Rotor installation                                                         | primary 500 ton crane           | 1                    | 800                    | 597                    |                | 130 days  | 2 hrs/day  | 260                              |                        | 1.1              | 0.1 | 0.0             | 0.6 | 0.0              | 0.0               | 120.5           | 0.0  |
| Subtotal                                                                   |                                 |                      |                        |                        |                |           |            |                                  |                        | 3.7              | 0.4 | 0.0             | 2.1 | 0.1              | 0.1               | 433             | 0.0  |
| ESP Installation                                                           |                                 |                      |                        |                        |                |           |            |                                  |                        |                  |     |                 |     |                  |                   |                 |      |
| Setting template for ESP installation                                      | crane                           | 1                    | 3,000                  | 2,237                  |                | 1         | 16 hrs.    | 16                               |                        | 0.3              | 0.0 | 0.0             | 0.1 | 0.0              | 0.0               | 27.8            | 0.0  |
| Pile setting                                                               | crane                           | 1                    | 3,000                  | 2,237                  |                | 6         | 3 hrs.     | 18                               |                        | 0.3              | 0.0 | 0.0             | 0.2 | 0.0              | 0.0               | 31.3            | 0.0  |
| Pile driving                                                               | Hydraulic ram                   | 1                    | 3,200                  | 2,386                  |                | 6         | 2 hrs.     | 12                               | IHC S-500 hydrohammer  | 0.2              | 0.0 | 0.0             | 0.1 | 0.0              | 0.0               | 22.3            | 0.0  |
| Subtotal                                                                   |                                 |                      |                        |                        |                |           |            |                                  |                        | 0.7              | 0.1 | 0.0             | 0.4 | 0.0              | 0.0               | 81              | 0.0  |
| TOTAL Construction Emissions Over 1 to 2-Year Construction Duration        |                                 |                      |                        |                        |                |           |            |                                  |                        | 14.6             | 1.6 | 0.0             | 8.6 | 0.5              | 0.5               | 1,732           | 0.0  |

All operating hours will be metered to track actual emissions.

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

Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009

Emission Factors - Ocean Going Vessel Main Engines, Medium-Speed Diesel, Marine Diesel Oil, g/kWh (Table 2-9)

| Engine                                                            | NOx        | VOC (HC)        | SO <sub>2</sub>       | CO        | PM <sub>10</sub>       | PM <sub>2.5</sub>       | CO <sub>2</sub>       | HAPs        |
|-------------------------------------------------------------------|------------|-----------------|-----------------------|-----------|------------------------|-------------------------|-----------------------|-------------|
| MSD & MDO                                                         | 13.2       | 0.50            | 0.01                  | 1.10      | 0.47                   | 0.43                    | 646.08                | 0.00635     |
| <b>Emission Factors - Harbor Craft, Tier 0, g/kWh (Table 3-8)</b> |            |                 |                       |           |                        |                         |                       |             |
| <b>Engine Power</b>                                               | <b>NOx</b> | <b>VOC (HC)</b> | <b>SO<sub>2</sub></b> | <b>CO</b> | <b>PM<sub>10</sub></b> | <b>PM<sub>2.5</sub></b> | <b>CO<sub>2</sub></b> | <b>HAPs</b> |
| 225 - 449 kW (Cat. 1)                                             | 10.0       | 0.27            | 0.001                 | 1.50      | 0.30                   | 0.29                    | 690.00                | 0.0161      |
| 450 - 559 kW (Cat. 1)                                             | 10.0       | 0.27            | 0.001                 | 1.50      | 0.30                   | 0.29                    | 690.00                | 0.0161      |
| 560 - 999 kW (Cat. 1)                                             | 10.0       | 0.27            | 0.001                 | 1.50      | 0.30                   | 0.29                    | 690.00                | 0.00635     |
| 1,000 kW (Cat. 1)                                                 | 13.0       | 0.27            | 0.001                 | 2.50      | 0.30                   | 0.29                    | 690.00                | 0.00635     |
| 1,000 - 3,000 kW (Cat. 2)                                         | 13.2       | 0.50            | 0.001                 | 1.10      | 0.72                   | 0.70                    | 690.00                | 0.00635     |

Category 1 vessels are defined by EPA as small harbor craft and recreational propulsion (&lt;1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (1,000-3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (&gt;3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 &amp; 3.4)

Load Factors are from Table 3-4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

Outboard Emission Factors (g/bhp-hr) for 50-100HP 4-stroke, outboard engines. Based on Exhaust Emission Factors for Nonroad Engine Modeling: Spark-Ignition, EPA420-R-05-019, Table 10. Worst case emissions factors were selected from carbureted, indirect injection and direct injection engine types. When calculating emissions, HC and PM were equated with VOC and PM10, respectively.

| HC   | NOx  | SO <sub>2</sub> | CO     | PM   | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs |
|------|------|-----------------|--------|------|-------------------|-----------------|------|
| 5.82 | 5.82 |                 | 152.25 | 0.06 |                   |                 |      |

| Activity Type                                    | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                        | Count     | Duration   | Operating<br>Hours<br>(per unit) | Assumptions                                                  | Load Factor | Auxiliary Engine<br>Power Adjustment | Emissions (tons) |      |                 |     |                  |                   |                 |      |     |  |
|--------------------------------------------------|---------------------------------|----------------------|------------------------|------------------------|---------------------------------|-----------|------------|----------------------------------|--------------------------------------------------------------|-------------|--------------------------------------|------------------|------|-----------------|-----|------------------|-------------------|-----------------|------|-----|--|
|                                                  |                                 |                      |                        |                        |                                 |           |            |                                  |                                                              |             |                                      | NOx              | VOC  | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs |     |  |
| Maintenance - per year                           |                                 |                      |                        |                        |                                 |           |            |                                  |                                                              |             |                                      |                  |      |                 |     |                  |                   |                 |      |     |  |
| Crew transport                                   | Crew boats                      | 1                    | 750                    | 559                    | Travel<br>Falmouth and<br>WP    | 504 trips | 1 hr/trip  | 504                              | avg. 1 trips/day X<br>252 days                               | 0.45        | 1.100                                | 1.5              | 0.0  | 0.0             | 0.2 | 0.0              | 106.0             | 0.0             |      |     |  |
| Support vessel                                   | Maintenance vessels             | 1                    | 1,500                  | 1,119                  | Travel<br>Falmouth and<br>WP    | 504 trips | 1 hr/trip  | 504                              | avg. 1 trips/day X<br>252 days                               | 0.43        | 1.100                                | 3.9              | 0.1  | 0.0             | 0.3 | 0.2              | 202.6             | 0.0             |      |     |  |
| Special duty supply vessel                       | Maintenance vessel              | 1                    | 3,000                  | 2,237                  | Travel<br>New Bedford<br>and WP | 48 trips  | 5 hrs/trip | 230                              | Required<br>irregularly<br>assume 2 round<br>trips per month | 0.43        | 1.100                                | 3.5              | 0.1  | 0.0             | 0.3 | 0.2              | 185.1             | 0.0             |      |     |  |
| Support vessel                                   | Maintenance vessels             | 1                    | 1,500                  | 1,119                  | Travel<br>New Bedford<br>and WP | 504 trips | 1 hr/trip  | 483                              | avg. 1 trips/day X<br>252 days                               | 0.43        | 1.100                                | 3.7              | 0.1  | 0.0             | 0.3 | 0.2              | 194.3             | 0.0             |      |     |  |
| Crew Movement                                    | Zodiac Boat                     | 1                    | 100                    | 75                     | Daily activity                  | 504 trips | 1 hr/trip  | 504                              | avg. 1 trips/day X<br>252 days                               |             |                                      | 0.3              | 0.3  |                 | 8.5 | 0.003            |                   |                 |      |     |  |
| Sub-Total                                        |                                 |                      |                        |                        |                                 |           |            |                                  |                                                              |             |                                      | 13.0             | 0.8  | 0.0             | 9.6 | 0.7              | 0.6               | 688             | 0.0  |     |  |
| Total Annual Operation Emissions (tons per year) |                                 |                      |                        |                        |                                 |           |            |                                  |                                                              |             |                                      |                  | 13.0 | 0.8             | 0.0 | 9.6              | 0.7               | 0.6             | 688  | 0.0 |  |

Note: Hours were prorated based on the following assumptions:

- New Bedford to 25-mile Radius Border = 2.2 Miles

- New Bedford to Wind Park = 53.8 Miles

- Miles are nautical miles

All operating hours will be metered to track actual emissions.

**Cape Wind Energy Project**  
**Operation Emissions Outside of 25 miles in MA Waters**

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

Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009

Emission Factors - Ocean Going Vessel Main Engines, Medium-Speed Diesel, Marine Diesel Oil, g/kWh (Table 2-9)

Diesel Fuel Sulfur Content: 15 ppm

| Engine                                                            | NOx        | VOC (HC)        | SO <sub>2</sub>       | CO        | PM <sub>10</sub>       | PM <sub>2.5</sub>       | CO <sub>2</sub>       | HAPs        |
|-------------------------------------------------------------------|------------|-----------------|-----------------------|-----------|------------------------|-------------------------|-----------------------|-------------|
| MSD & MDO                                                         | 13.2       | 0.50            | 0.01                  | 1.10      | 0.47                   | 0.43                    | 646.08                | 0.00635     |
| <b>Emission Factors - Harbor Craft, Tier 0, g/kWh (Table 3-8)</b> |            |                 |                       |           |                        |                         |                       |             |
| <b>Engine Power</b>                                               | <b>NOx</b> | <b>VOC (HC)</b> | <b>SO<sub>2</sub></b> | <b>CO</b> | <b>PM<sub>10</sub></b> | <b>PM<sub>2.5</sub></b> | <b>CO<sub>2</sub></b> | <b>HAPs</b> |
| 225 - 449 kW (Cat. 1)                                             | 10.0       | 0.27            | 0.001                 | 1.50      | 0.30                   | 0.29                    | 690.00                | 0.0161      |
| 450 - 559 kW (Cat. 1)                                             | 10.0       | 0.27            | 0.001                 | 1.50      | 0.30                   | 0.29                    | 690.00                | 0.0161      |
| 560 - 999 kW (Cat. 1)                                             | 10.0       | 0.27            | 0.001                 | 1.50      | 0.30                   | 0.29                    | 690.00                | 0.00635     |
| 1,000 kW (Cat. 1)                                                 | 13.0       | 0.27            | 0.001                 | 2.50      | 0.30                   | 0.29                    | 690.00                | 0.00635     |
| 1,000 - 3,000 kW (Cat. 2)                                         | 13.2       | 0.50            | 0.001                 | 1.10      | 0.72                   | 0.70                    | 690.00                | 0.00635     |

Category 1 vessels are defined by EPA as small harbor craft and recreational propulsion (&lt;1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (1,000-3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (&gt;3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 &amp; 3.4)

Load Factors are from Table 3-4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

| Activity Type                                                             |  | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                        | Count     | Duration   | Operating<br>Hours<br>(per unit) | Assumptions                                            | Load Factor | Auxiliary Engine<br>Power Adjustment | Emissions (tons) |     |                 |     |                  |                   |                 | HAPs |     |
|---------------------------------------------------------------------------|--|---------------------------------|----------------------|------------------------|------------------------|---------------------------------|-----------|------------|----------------------------------|--------------------------------------------------------|-------------|--------------------------------------|------------------|-----|-----------------|-----|------------------|-------------------|-----------------|------|-----|
|                                                                           |  |                                 |                      |                        |                        |                                 |           |            |                                  |                                                        |             |                                      | NOx              | VOC | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> |      |     |
| Operation Period - Activities beyond 25 Miles of the Project in MA Waters |  |                                 |                      |                        |                        |                                 |           |            |                                  |                                                        |             |                                      |                  |     |                 |     |                  |                   |                 |      |     |
| Maintenance - per year                                                    |  |                                 |                      |                        |                        |                                 |           |            |                                  |                                                        |             |                                      |                  |     |                 |     |                  |                   |                 |      |     |
| Special duty supply vessel                                                |  | Maintenance vessel              | 1                    | 3,000                  | 2,237                  | Travel<br>New Bedford<br>and WP | 48 trips  | 5 hrs/trip | 10                               | Required<br>irregularly<br>assume 2 trips<br>per month | 0.43        | 1.100                                | 0.2              | 0.0 | 0.0             | 0.0 | 0.0              | 0.0               | 7.9             | 0.0  |     |
| Support vessel                                                            |  | Maintenance vessels             | 1                    | 1,500                  | 1,119                  | Travel<br>New Bedford<br>and WP | 504 trips | 1 hr/trip  | 21                               | avg. 1 trips/day x<br>252 days                         | 0.43        | 1.100                                | 0.2              | 0.0 | 0.0             | 0.0 | 0.0              | 0.0               | 8.3             | 0.0  |     |
| Total Operation Emissions                                                 |  |                                 |                      |                        |                        |                                 |           |            |                                  |                                                        |             |                                      | 0.3              | 0.0 | 0.0             | 0.0 | 0.0              | 0.0               | 16              | 0.0  | 0.0 |

Note: Hours were prorated based on the following assumptions:

- New Bedford to 25-mile Radius Border = 2.2 Miles

- New Bedford to Wind Park = 53.8 Miles

- Miles are nautical miles

All operating hours will be metered to track actual emissions.

Cape Wind Energy Project  
Construction Emissions Onshore Activities - Rhode Island

| Emission Factors (g/mile) from EPA's MOBILE6 Vehicle Model Guidance Document, EPA420-F-05-022                             |       |          |                 |      |                  |                   |                 |         |  |
|---------------------------------------------------------------------------------------------------------------------------|-------|----------|-----------------|------|------------------|-------------------|-----------------|---------|--|
| Vehicle                                                                                                                   | NOx   | VOC      | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| Pickup truck/SUV                                                                                                          | 1.22  | 1.61     |                 | 15.7 | 0.0065           | 0.006             |                 |         |  |
| Emission Factors (g/hp-hr) Diesel Recip. >600 hp Based on AP-42 Vol.1, Tables 3.4-1 - 3.4-4                               |       |          |                 |      |                  |                   |                 |         |  |
| Equipment                                                                                                                 | NOx * | VOC      | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| Diesel Engine                                                                                                             | 6.86  | 0.33     | 0.01            | 2.4  | 0.32             | 0.32              | 526.16          | 0.00474 |  |
| * NOx emission factor used is the Tier 1 Emission Standard for nonroad engines (40 CFR 89.112(1)).                        |       |          |                 |      |                  |                   |                 |         |  |
| Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009 |       |          |                 |      |                  |                   |                 |         |  |
| Emission Factors - Ocean Going Vessel Main Engines, Medium-Speed Diesel, Marine Diesel Oil, g/kWh (Table 2-9)             |       |          |                 |      |                  |                   |                 |         |  |
| Engine                                                                                                                    | NOx   | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| MSD & MDO                                                                                                                 | 13.2  | 0.50     | 0.20            | 1.10 | 0.47             | 0.43              | 646.08          | 0.00635 |  |
| Emission Factors - Harbor Craft, Tier 0, g/kWh (Table 3-8)                                                                |       |          |                 |      |                  |                   |                 |         |  |
| Engine Power                                                                                                              | NOx   | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| 225 - 449 kW (Cat. 1)                                                                                                     | 10.0  | 0.27     | 0.000           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |  |
| 450 - 559 kW (Cat. 1)                                                                                                     | 10.0  | 0.27     | 0.000           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |  |
| 560 - 999 kW (Cat. 1)                                                                                                     | 10.0  | 0.27     | 0.000           | 1.50 | 0.30             | 0.29              | 690.00          | 0.00635 |  |
| 1,000 kW (Cat. 1)                                                                                                         | 13.0  | 0.27     | 0.000           | 2.50 | 0.30             | 0.29              | 690.00          | 0.00635 |  |
| 1,000 - 3,000 kW (Cat. 2)                                                                                                 | 13.2  | 0.50     | 0.000           | 1.10 | 0.72             | 0.70              | 690.00          | 0.00635 |  |

Category 1 vessels are defined by EPA as small harbor craft and recreational propulsion (<1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (1,000-3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (>3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 & 3.4)

Load Factors are from Table 3-4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

| Activity Type                                               |  | Emission Source | Number of Sources | Equipment Size (HP) | Equipment Size (kW) | Activity | Count     | Duration      | Operating Hours (per unit) | Units | Load Factor | Auxiliary Engine Power Adjustment | Emissions (tons) |       |                 |     |                  |                   |                 |       |     |  |  |  |
|-------------------------------------------------------------|--|-----------------|-------------------|---------------------|---------------------|----------|-----------|---------------|----------------------------|-------|-------------|-----------------------------------|------------------|-------|-----------------|-----|------------------|-------------------|-----------------|-------|-----|--|--|--|
|                                                             |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   | NOx              | VOC   | SO <sub>2</sub> | CO  | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs  |     |  |  |  |
| Construction Period - Onshore - Rhode Island                |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   |                  |       |                 |     |                  |                   |                 |       |     |  |  |  |
| Port Worker Commute                                         |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   |                  |       |                 |     |                  |                   |                 |       |     |  |  |  |
| Vehicle Emissions                                           |  |                 | 25                |                     |                     | 240 days | 480 trips | 30 miles/trip | 14,400                     | miles |             |                                   |                  | 0.5   | 0.6             | 0.0 | 6.2              | 0.0               | 0.0             | 0.0   | 0.0 |  |  |  |
| Subtotal                                                    |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   |                  | 0.5   | 0.6             | 0.0 | 6.2              | 0.0               | 0.0             | 0.0   | 0.0 |  |  |  |
| Delivery of Parts & Materials                               |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   |                  |       |                 |     |                  |                   |                 |       |     |  |  |  |
| Cargo Barge Tow Tug - Light                                 |  |                 | 1                 | 1,500               | 1,119               | Cable    | 15 trips  | 4 hrs/trip    | 60                         | hours | 0.31        | 1.100                             |                  | 0.3   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 17.4  | 0.0 |  |  |  |
| Cargo Barge Tow Tug - Middle                                |  |                 | 1                 | 3,000               | 2,237               | Scour    | 2 trips   | 4 hrs/trip    | 8                          | hours | 0.31        | 1.100                             |                  | 0.1   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 4.6   | 0.0 |  |  |  |
| Cargo Barge Tow Tug - Heavy                                 |  |                 | 1                 | 6,000               | 4,474               | All Else | 410 trips | 4 hrs/trip    | 1,640                      | hours | 0.68        | 1.100                             |                  | 79.8  | 3.0             | 1.2 | 6.6              | 2.8               | 3905.4          | 0.0   |     |  |  |  |
| Subtotal                                                    |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   |                  | 80.2  | 3.0             | 1.2 | 6.7              | 2.9               | 2.6             | 3,927 | 0.0 |  |  |  |
| Construction Staging Activities - Unloading/Staging/Loading |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   |                  |       |                 |     |                  |                   |                 |       |     |  |  |  |
| Piles & Transition Piles                                    |  |                 | 1                 | 800                 | 597                 |          | 43 trips  | 8 hrs/trip    | 344                        | hours |             |                                   |                  | 2.1   | 0.1             | 0.0 | 0.7              | 0.1               | 0.1             | 159   | 0.0 |  |  |  |
| Scour Installation Equipment                                |  |                 | 1                 | 800                 | 597                 |          | 2 trips   | 8 hrs/trip    | 16                         | hours |             |                                   |                  | 0.1   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 7     | 0.0 |  |  |  |
| Rock Armor                                                  |  |                 | 1                 | 800                 | 597                 |          | 138 trips | 8 hrs/trip    | 1,104                      | hours |             |                                   |                  | 6.7   | 0.3             | 0.0 | 2.3              | 0.3               | 0.3             | 512   | 0.0 |  |  |  |
| Filler Material                                             |  |                 | 1                 | 800                 | 597                 |          | 185 trips | 8 hrs/trip    | 1,480                      | hours |             |                                   |                  | 8.9   | 0.4             | 0.0 | 3.1              | 0.4               | 0.4             | 686   | 0.0 |  |  |  |
| 115 kV Cable                                                |  |                 | 1                 | 800                 | 597                 |          | 2 trips   | 8 hrs/trip    | 16                         | hours |             |                                   |                  | 0.1   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 7     | 0.0 |  |  |  |
| 33 kV Cable                                                 |  |                 | 1                 | 800                 | 597                 |          | 13 trips  | 8 hrs/trip    | 104                        | hours |             |                                   |                  | 0.6   | 0.0             | 0.0 | 0.2              | 0.0               | 0.0             | 48    | 0.0 |  |  |  |
| Turbines                                                    |  |                 | 1                 | 800                 | 597                 |          | 43 trips  | 8 hrs/trip    | 344                        | hours |             |                                   |                  | 2.1   | 0.1             | 0.0 | 0.7              | 0.1               | 0.1             | 159   | 0.0 |  |  |  |
| ESP Deck                                                    |  |                 | 1                 | 800                 | 597                 |          | 1 trip    | 8 hrs/trip    | 8                          | hours |             |                                   |                  | 0.0   | 0.0             | 0.0 | 0.0              | 0.0               | 0.0             | 4     | 0.0 |  |  |  |
| Subtotal                                                    |  |                 |                   |                     |                     |          |           |               | 3,416                      |       |             |                                   |                  | 20.6  | 1.0             | 0.0 | 7.2              | 1.0               | 1.0             | 1,584 | 0.0 |  |  |  |
| TOTAL Emissions Over Construction Duration                  |  |                 |                   |                     |                     |          |           |               |                            |       |             |                                   |                  | 101.3 | 4.7             | 1.2 | 20.1             | 3.8               | 3.6             | 5,511 | 0.1 |  |  |  |

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.

| Emission Factors (g/hp-hr) from EPA's Nonroad Engine Model Guidance Document, EPA420-P-04-009 |       |       |                 |       |                  |                   |       |
|-----------------------------------------------------------------------------------------------|-------|-------|-----------------|-------|------------------|-------------------|-------|
| Equipment                                                                                     | NOx   | VOC   | SO <sub>2</sub> | CO    | PM <sub>10</sub> | PM <sub>2.5</sub> | HAPs  |
| Backhoes                                                                                      | 7.220 | 1.850 | 0.950           | 8.210 | 1.370            | 0.910             | 0.000 |
| Bore/Drill Rigs                                                                               | 7.150 | 0.600 | 0.730           | 2.290 | 0.500            | 0.490             | 0.000 |
| Cement Mixers                                                                                 | 7.280 | 0.610 | 0.730           | 2.320 | 0.480            | 0.470             | 0.000 |
| Dump Trucks                                                                                   | 5.490 | 0.440 | 0.740           | 2.070 | 0.410            | 0.400             | 0.000 |
| Excavators                                                                                    | 4.600 | 0.340 | 0.740           | 1.300 | 0.320            | 0.310             | 0.000 |
| Front End Loaders                                                                             | 5.000 | 0.380 | 0.740           | 1.550 | 0.350            | 0.340             | 0.000 |
| Graders                                                                                       | 4.730 | 0.350 | 0.740           | 1.360 | 0.330            | 0.320             | 0.000 |
| Trenchers                                                                                     | 5.810 | 0.510 | 0.740           | 2.440 | 0.460            | 0.440             | 0.000 |

| Emission Factors (g/mile) from EPA's MOBILE6 Vehicle Model Guidance Document, EPA420-F-05-022 |      |      |                 |       |                  |                   |       |
|-----------------------------------------------------------------------------------------------|------|------|-----------------|-------|------------------|-------------------|-------|
| Vehicle                                                                                       | NOx  | VOC  | SO <sub>2</sub> | CO    | PM <sub>10</sub> | PM <sub>2.5</sub> | HAPs  |
| Heavy-Duty Trucks                                                                             | 4.97 | 0.29 | 0.13            | 1.32  | 0.13             | 0.13              | 0.000 |
| Pick-up Trucks                                                                                | 1.22 | 1.61 | 0.065           | 15.70 | 0.0065           | 0.0065            | 0.000 |

| Emission Factor (tons/acre-month) from Mid-Atlantic Regional Air Management Association guidance. |     |     |                 |    |                  |                   |      |
|---------------------------------------------------------------------------------------------------|-----|-----|-----------------|----|------------------|-------------------|------|
| Emission                                                                                          | NOx | VOC | SO <sub>2</sub> | CO | PM <sub>10</sub> | PM <sub>2.5</sub> | HAPs |
| Fugitive Emissions                                                                                |     |     |                 |    | 0.11             | 0.02              |      |

| Emission Factors (g/hp-hr) Diesel Recip. <600 hp Based on AP-42 Vol.1, Tables 3.3-1 - 3.3-2 |        |       |                 |      |                  |                   |         |
|---------------------------------------------------------------------------------------------|--------|-------|-----------------|------|------------------|-------------------|---------|
| Equipment                                                                                   | NOx ** | TOC * | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | HAPs    |
| Crane/Winch                                                                                 | 6.86   | 1.14  | 0.01            | 3.02 | 1.00             | 1.00              | 0.00003 |

\* 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)).

Diesel Fuel Sulfur Content: 15 ppm

| Activity Type                                 | Emission Source         | Number of Sources | Equipment Size (HP) | Equipment Size (kW) | Activity | Count    | Duration   | Operating Hours (per unit) | Units       | Emissions (tons) |     |                 |      |                  |                   | CO <sub>2</sub> | HAPs |
|-----------------------------------------------|-------------------------|-------------------|---------------------|---------------------|----------|----------|------------|----------------------------|-------------|------------------|-----|-----------------|------|------------------|-------------------|-----------------|------|
|                                               |                         |                   |                     |                     |          |          |            |                            |             | NOx              | VOC | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> |                 |      |
| 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 | 0.2             | 0.3  | 0.1              | 0.1               | 133             | 0.0  |
|                                               | Backhoes                | 1                 | 100                 | 75                  |          | 75 days  | 10 hrs/day | 750                        | hours       | 0.6              | 0.2 | 0.1             | 0.7  | 0.1              | 0.1               | 57              | 0.0  |
|                                               | Dump Trucks             | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.4              | 0.1 | 0.2             | 0.5  | 0.1              | 0.1               | 133             | 0.0  |
| Trench Excavation                             | Excavators              | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.1              | 0.1 | 0.2             | 0.3  | 0.1              | 0.1               | 133             | 0.0  |
|                                               | Trenchers               | 1                 | 175                 | 131                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 0.8              | 0.1 | 0.1             | 0.4  | 0.1              | 0.1               | 77              | 0.0  |
|                                               | Dump Trucks             | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.4              | 0.1 | 0.2             | 0.5  | 0.1              | 0.1               | 133             | 0.0  |
| HDD Boring                                    | Bore/Drill Rigs         | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.8              | 0.1 | 0.2             | 0.6  | 0.1              | 0.1               | 131             | 0.0  |
|                                               | HDD Drill Rig           | 1                 | 300                 | 224                 |          | 20 days  | 10 hrs/day | 200                        | hours       | 0.5              | 0.0 | 0.0             | 0.2  | 0.0              | 0.0               | 35              | 0.0  |
|                                               | Cement Mixer            | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.8              | 0.2 | 0.2             | 0.6  | 0.1              | 0.1               | 131             | 0.0  |
| Concrete Casting of Ductbank                  | Front End Loaders       | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.2              | 0.1 | 0.2             | 0.4  | 0.1              | 0.1               | 131             | 0.0  |
|                                               | Excavators              | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.1              | 0.1 | 0.2             | 0.3  | 0.1              | 0.1               | 133             | 0.0  |
|                                               | Backhoes                | 1                 | 100                 | 75                  |          | 75 days  | 10 hrs/day | 750                        | hours       | 0.6              | 0.2 | 0.1             | 0.7  | 0.1              | 0.1               | 57              | 0.0  |
| Dump Trucks                                   | Dump Trucks             | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.4              | 0.1 | 0.2             | 0.5  | 0.1              | 0.1               | 133             | 0.0  |
|                                               | Graders                 | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.2              | 0.1 | 0.2             | 0.3  | 0.1              | 0.1               | 133             | 0.0  |
|                                               | All Types/Activities    |                   |                     |                     |          | 1 acre   | 5 months   | 5                          | acre-months | 0.0              | 0.0 | 0.0             | 0.0  | 0.6              | 0.1               | 0.0             | 0.0  |
| Fugitive Emissions                            | Heavy-Duty Trucks       | 2                 | -                   | -                   |          | 150 days | 60 mi/day  | 18,000                     | miles       | 0.2              | 0.0 | 0.0             | 0.1  | 0.0              | 0.0               | 0.0             | 0.0  |
| Delivery of Supplies                          | Pick-up Trucks          | 10                |                     | -                   |          | 150 days | 120 mi/day | 180,000                    | miles       | 2.4              | 3.2 | 0.0             | 31.1 | 0.0              | 0.0               | 0.0             | 0.0  |
| Worker Transport                              |                         |                   |                     |                     |          |          |            |                            |             |                  |     |                 |      |                  |                   |                 |      |
| Subtotal                                      |                         |                   |                     |                     |          |          |            |                            |             | 18.6             | 4.7 | 2.1             | 37.4 | 1.8              | 1.4               | 1,552           | 0.0  |
| 115kV Transmission Line Installation          |                         |                   |                     |                     |          |          |            |                            |             |                  |     |                 |      |                  |                   |                 |      |
| Cable Pulling                                 | Heavy-Duty Trucks       | 1                 |                     | -                   |          | 75 days  | 10 mi/day  | 750                        | miles       | 0.0              | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 0               | 0.0  |
|                                               | Winch                   | 1                 | 300                 | 224                 |          | 75 days  | 10 hrs/day | 750                        | hours       | 1.7              | 0.3 | 0.0             | 0.7  | 0.2              | 0.2               | 129             | 0.0  |
|                                               | Power Pole Installation | Bore/Drill Rigs   | 1                   | 300                 | 224      |          | 2 days     | 10 hrs/day                 | 20          | hours            | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 0               | 0.0  |
| Fugitive Emissions                            | Crane                   | 1                 | 400                 | 298                 |          | 2 days   | 10 hrs/day | 20                         | hours       | 0.1              | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 5               | 0.0  |
|                                               | Heavy-Duty Trucks       | 1                 |                     | -                   |          | 2 days   | 10 mi/day  | 750                        | miles       | 0.0              | 0.0 | 0.0             | 0.0  | 0.0              | 0.0               | 0               | 0.0  |
|                                               | All Types/Activities    |                   |                     |                     |          | 1 acre   | 5 months   | 5                          | acre-months | 0.0              | 0.0 | 0.0             | 0.0  | 0.6              | 0.1               | 0               | 0.0  |
| Delivery of Supplies                          | Heavy-Duty Trucks       | 2                 |                     | -                   |          | 150 days | 60 mi/day  | 18,000                     | total miles | 0.2              | 0.0 | 0.0             | 0.1  | 0.0              | 0.0               | 0               | 0.0  |
| Worker Transport                              | Pick-up Trucks          | 10                |                     | -                   |          | 150 days | 120 mi/day | 180,000                    | total miles | 2.4              | 3.2 | 0.0             | 31.1 | 0.0              | 0.0               | 0               | 0.0  |
| Subtotal                                      |                         |                   |                     |                     |          |          |            |                            |             | 4.4              | 3.5 | 0.0             | 32.0 | 0.8              | 0.4               | 137             | 0.0  |
| TOTAL Emissions Over Construction Duration    |                         |                   |                     |                     |          |          |            |                            |             |                  |     |                 |      |                  |                   |                 |      |
|                                               |                         |                   |                     |                     |          |          |            |                            |             | 23.0             | 8.2 | 2.1             | 69.4 | 2.7              | 1.8               | 1,689.4         | 0.0  |

All operating hours will be metered to track actual emissions.



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

Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009

| Engine                    |  | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs   |
|---------------------------|--|------|----------|-----------------|------|------------------|-------------------|-----------------|--------|
| MSD & MDO                 |  | 13.2 | 0.30     | 0.20            | 1.10 | 0.37             | 0.43              | 646.08          | 0.0635 |
| Engine Power              |  | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs   |
| 225 - 449 kW (Cat. 1)     |  | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161 |
| 450 - 559 kW (Cat. 1)     |  | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161 |
| 560 - 899 kW (Cat. 1)     |  | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0635 |
| 1,000 kW (Cat. 1)         |  | 13.0 | 0.27     | 0.043           | 2.50 | 0.30             | 0.29              | 690.00          | 0.0635 |
| 1,000 - 3,000 kW (Cat. 2) |  | 13.2 | 0.30     | 0.043           | 1.10 | 0.72             | 0.70              | 690.00          | 0.0635 |

Category 1 vessels are defined by EPA as small harbor craft and recreational propulsion (<1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (1,000-3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (>3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 & 3.4)

Load Factors are from Table 3-4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

| Emissions (tons) = Engine Power Rating (KW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources) |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------|------------------------|------------------------|--------------------------------|-----------|---------------------|----------------------------|------------------------------------|-------------|-----------------------------------|------------------|------|-----------------|------|------------------|-------------------|-----------------|------|
| Activity Type                                                                                                                                              | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                       | Count     | Duration (hrs/trip) | Operating Hours (per unit) | Assumptions                        | Load Factor | Auxiliary Engine Power Adjustment | Emissions (tons) |      |                 |      |                  |                   |                 |      |
|                                                                                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | NOx              | VOC  | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPS |
| 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/for Quonset Point, RI | 4 trips   | 2                   | 10                         |                                    | 0.31        | 1.100                             | 0.11             | 0.00 | 0.00            | 0.01 | 0.01             | 0.01              | 5.51            | 0.00 |
| Transport piles & transition pieces                                                                                                                        | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 86 trips  | 2                   | 204                        | avg. 3 piles per trip, 130 piles   | 0.68        | 1.100                             | 9.94             | 0.38 | 0.15            | 0.83 | 0.35             | 0.32              | 465.38          | 0.00 |
| Move scour installation equipment                                                                                                                          | attendant tug                   | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 4 trips   | 2                   | 10                         | This is done twice (once per year) | 0.31        | 1.100                             | 0.11             | 0.00 | 0.00            | 0.01 | 0.01             | 0.00              | 5.51            | 0.00 |
| Transport rock armor barges                                                                                                                                | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 276 trips | 2                   | 656                        | Spd. 8 knts                        | 0.68        | 1.100                             | 31.89            | 1.21 | 0.46            | 2.66 | 1.14             | 1.04              | 1560.95         | 0.02 |
| Transport filler material barges                                                                                                                           | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 370 trips | 2                   | 879                        | Spd. 8 knts                        | 0.68        | 1.100                             | 42.75            | 1.62 | 0.64            | 3.56 | 1.52             | 1.39              | 2092.58         | 0.02 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 84.8             | 3.2  | 2.3             | 7.1  | 3.0              | 2.8               | 4,151           | 0.0  |
|                                                                                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| Activity Type                                                                                                                                              | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                       | Count     | Duration (hrs/trip) | Operating Hours (per unit) | Assumptions                        | Load Factor | Auxiliary Engine Power Adjustment | Emissions (tons) |      |                 |      |                  |                   |                 |      |
|                                                                                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | NOx              | VOC  | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPS |
| Cable laying                                                                                                                                               |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| 115 kW Cable laying barge                                                                                                                                  | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 4 trips   | 2                   | 10                         |                                    | 0.31        | 1.100                             | 0.05             | 0.00 | 0.00            | 0.00 | 0.00             | 0.00              | 2.75            | 0.00 |
| 33 kW Cable laying barge                                                                                                                                   | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 26 trips  | 2                   | 62                         | 13 round trips                     | 0.31        | 1.100                             | 0.34             | 0.01 | 0.00            | 0.03 | 0.02             | 0.02              | 17.90           | 0.00 |
| Move Crane barge to cofferdam location                                                                                                                     | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 4 trips   | 2                   | 10                         |                                    | 0.31        | 1.100                             | 0.05             | 0.00 | 0.00            | 0.00 | 0.00             | 0.00              | 2.75            | 0.00 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 0.4              | 0.0  | 0.0             | 0.0  | 0.0              | 0.0               | 23              | 0.0  |
|                                                                                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| Turbine installation                                                                                                                                       | one specialized vessel          | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 86 trips  | 2                   | 204                        |                                    | 0.83        | 1.100                             | 12.13            | 0.46 | 0.18            | 1.01 | 0.43             | 0.40              | 593.67          | 0.01 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 12.1             | 0.5  | 0.2             | 1.0  | 0.4              | 0.4               | 594             | 0.0  |
|                                                                                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| ESP Installation                                                                                                                                           |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| Crane barge towing                                                                                                                                         | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 2                   | 5                          |                                    | 0.31        | 1.100                             | 0.05             | 0.00 | 0.00            | 0.00 | 0.00             | 0.00              | 2.75            | 0.00 |
| Pile Installation barge towing                                                                                                                             | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 2                   | 5                          |                                    | 0.31        | 1.100                             | 0.05             | 0.00 | 0.00            | 0.00 | 0.00             | 0.00              | 2.75            | 0.00 |
| ESP deck to wind farm                                                                                                                                      | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 2 trips   | 2                   | 5                          |                                    | 0.68        | 1.100                             | 0.23             | 0.01 | 0.00            | 0.02 | 0.01             | 0.01              | 11.31           | 0.00 |
| Crane barge towing                                                                                                                                         | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 2                   | 5                          |                                    | 0.31        | 1.100                             | 0.05             | 0.00 | 0.00            | 0.00 | 0.00             | 0.00              | 2.75            | 0.00 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 0.4              | 0.0  | 0.0             | 0.0  | 0.0              | 0.0               | 20              | 0.0  |
|                                                                                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| TOTAL Construction Emissions Over 2-year Construction Duration                                                                                             |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 97.8             | 3.7  | 1.5             | 8.1  | 3.5              | 3.2               | 4,788           | 0.0  |

- Quonset Point to RI Border = 19 Miles

- Miles are nautical miles

A vessel speed of 8 knots was assumed to determine the duration for each trip

All operating hours will be metered to track actual emissions.

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

Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009

| Emission Factors - Ocean Going Vessel Main Engines, Medium-Speed Diesel, Marine Diesel Oil, g/kWh (Table 2-3) |      |          |                 |      |                  |                   |                 |         |  |
|---------------------------------------------------------------------------------------------------------------|------|----------|-----------------|------|------------------|-------------------|-----------------|---------|--|
| Engine                                                                                                        | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| MSD & MDO                                                                                                     | 13.2 | 0.50     | 0.20            | 1.10 | 0.47             | 0.43              | 646.08          | 0.00635 |  |
| Emission Factors - Harbor Craft, Tier 0, g/kWh (Table 3-8)                                                    |      |          |                 |      |                  |                   |                 |         |  |
| Engine Power                                                                                                  | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| 225 - 449 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |  |
| 450 - 559 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.0161  |  |
| 560 - 899 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 690.00          | 0.00635 |  |
| 1,000 - 3,000 kW (Cat. 2)                                                                                     | 13.2 | 0.27     | 0.043           | 2.50 | 0.30             | 0.29              | 690.00          | 0.00635 |  |

Category 1 vessels are defined by EPA as small harbor craft and recreational propulsion (<1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (1,000-3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (>3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 & 3.4)

Load Factors are from Table 3-4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (lb) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

| Activity Type                                                                    | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                       | Count     | Duration<br>(hr/trip) | Operating<br>Hours<br>(per unit) | Assumptions                        | Load Factor | Auxiliary Engine<br>Power Adjustment | Emissions (tons) |      |                 |      |                  |                   |                 |       |     |  |  |  |
|----------------------------------------------------------------------------------|---------------------------------|----------------------|------------------------|------------------------|--------------------------------|-----------|-----------------------|----------------------------------|------------------------------------|-------------|--------------------------------------|------------------|------|-----------------|------|------------------|-------------------|-----------------|-------|-----|--|--|--|
|                                                                                  |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      | NOx              | VOC  | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs  |     |  |  |  |
| 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/for Quonset Point, RI | 4 trips   | 1                     | 4                                |                                    | 0.31        | 1.100                                | 0.04             | 0.00 | 0.00            | 0.00 | 0.00             | 2.12              | 0.00            |       |     |  |  |  |
| Transport piles and transition pieces                                            | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 86 trips  | 1                     | 78                               | avg. 3 piles per trip, 130 piles   | 0.68        | 1.100                                | 3.82             | 0.14 | 0.06            | 0.32 | 0.12             | 186.97            | 0.00            |       |     |  |  |  |
| Move scour installation equipment                                                | attendant tug                   | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 4 trips   | 1                     | 4                                | This is done twice (once per year) | 0.31        | 1.100                                | 0.04             | 0.00 | 0.00            | 0.00 | 0.00             | 2.12              | 0.00            |       |     |  |  |  |
| Transport rock armor barges                                                      | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 276 trips | 1                     | 252                              | Spd. 8 knts                        | 0.68        | 1.100                                | 12.25            | 0.46 | 0.18            | 1.02 | 0.44             | 559.74            | 0.01            |       |     |  |  |  |
| Transport filler material barges                                                 | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 370 trips | 1                     | 338                              | Spd. 8 knts                        | 0.68        | 1.100                                | 16.43            | 0.62 | 0.25            | 1.37 | 0.58             | 803.99            | 0.01            |       |     |  |  |  |
| Subtotal                                                                         |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      | 32.6             | 1.2  | 0.5             | 2.7  | 1.2              | 1.1               | 1,595           | 0.0   |     |  |  |  |
| Construction Period - Activities within 25 Miles of the Project and in MA Waters |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      |                  |      |                 |      |                  |                   |                 |       |     |  |  |  |
| Cable laying                                                                     | 115 kV Cable laying barge       | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 4 trips   | 1                     | 4                                |                                    | 0.31        | 1.100                                | 0.02             | 0.00 | 0.00            | 0.00 | 0.00             | 1.06              | 0.00            |       |     |  |  |  |
| 33 kV Cable laying barge                                                         | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 26 trips  | 1                     | 24                               | 13 round trips                     | 0.31        | 1.100                                | 0.13             | 0.00 | 0.00            | 0.01 | 0.01             | 6.88              | 0.00            |       |     |  |  |  |
| Move Crane barge to cofferdam location                                           | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 4 trips   | 1                     | 4                                |                                    | 0.31        | 1.100                                | 0.02             | 0.00 | 0.00            | 0.00 | 0.00             | 1.06              | 0.00            |       |     |  |  |  |
| Subtotal                                                                         |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      | 0.2              | 0.0  | 0.0             | 0.0  | 0.0              | 9                 | 0.0             |       |     |  |  |  |
| Turbine installation                                                             | one specialized vessel          | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 86 trips  | 1                     | 78                               |                                    | 0.83        | 1.100                                | 4.66             | 0.16 | 0.07            | 0.39 | 0.17             | 228.10            | 0.00            |       |     |  |  |  |
| Subtotal                                                                         |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      | 4.7              | 0.2  | 0.1             | 0.4  | 0.2              | 228               | 0.0             |       |     |  |  |  |
| ESP Installation                                                                 |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      |                  |      |                 |      |                  |                   |                 |       |     |  |  |  |
| Crane barge towing                                                               | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 1                     | 2                                |                                    | 0.31        | 1.100                                | 0.02             | 0.00 | 0.00            | 0.00 | 0.00             | 1.06              | 0.00            |       |     |  |  |  |
| Pile installation barge towing                                                   | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 1                     | 2                                |                                    | 0.31        | 1.100                                | 0.02             | 0.00 | 0.00            | 0.00 | 0.00             | 1.06              | 0.00            |       |     |  |  |  |
| ESP deck to wind farm                                                            | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 2 trips   | 1                     | 2                                |                                    | 0.68        | 1.100                                | 0.09             | 0.00 | 0.00            | 0.01 | 0.00             | 4.35              | 0.00            |       |     |  |  |  |
| Crane barge towing                                                               | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 1                     | 2                                |                                    | 0.31        | 1.100                                | 0.02             | 0.00 | 0.00            | 0.00 | 0.00             | 1.06              | 0.00            |       |     |  |  |  |
| Subtotal                                                                         |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      | 0.1              | 0.0  | 0.0             | 0.0  | 0.0              | 8                 | 0.0             |       |     |  |  |  |
| TOTAL Construction Emissions Over 2-year Construction Duration                   |                                 |                      |                        |                        |                                |           |                       |                                  |                                    |             |                                      |                  | 37.6 | 1.4             | 0.6  | 3.1              | 1.3               | 1.2             | 1,839 | 0.0 |  |  |  |

- MA Border to 25-mile limit = 7.3 Miles

- Miles are nautical miles

A vessel speed of 8 knots was assumed to determine the duration for each trip

All operating hours will be metered to track actual emissions.

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

Emission Factors from EPA's "Current Methodologies and Best Practices in Preparing Port Emission Inventories", April 2009

| Emission Factors - Ocean Going Vessel Main Engines, Medium-Speed Diesel, Marine Diesel Oil, g/kWh (Table 2-9) |      |          |                 |      |                  |                   |                 |         |  |
|---------------------------------------------------------------------------------------------------------------|------|----------|-----------------|------|------------------|-------------------|-----------------|---------|--|
| Engine                                                                                                        | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| MSD & MDO                                                                                                     | 13.2 | 0.50     | 0.20            | 1.10 | 0.47             | 0.43              | 646.08          | 0.00535 |  |
| Emission Factors - Harbor Craft, Tier 0, g/kWh (Table 3-8)                                                    |      |          |                 |      |                  |                   |                 |         |  |
| Engine Power                                                                                                  | NOx  | VOC (HC) | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs    |  |
| 225 - 449 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 590.00          | 0.0161  |  |
| 450 - 559 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 590.00          | 0.0161  |  |
| 560 - 999 kW (Cat. 1)                                                                                         | 10.0 | 0.27     | 0.043           | 1.50 | 0.30             | 0.29              | 590.00          | 0.00635 |  |
| 1,000 - 3,000 kW (Cat. 1)                                                                                     | 13.0 | 0.27     | 0.043           | 2.50 | 0.30             | 0.29              | 590.00          | 0.00635 |  |
| 3,000 - 3,000 kW (Cat. 2)                                                                                     | 13.2 | 0.50     | 0.043           | 1.10 | 0.72             | 0.70              | 690.00          | 0.00635 |  |

Category 1 vessels are defined by EPA as small harbor craft and recreational propulsion (&lt;1,000 kW)

Category 2 vessels are defined by EPA as OGV auxiliary engines, harbor craft, and smaller OGV propulsion (1,000-3,000 kW)

Category 3 vessels are defined by EPA as OGV propulsion engines (&gt;3,000 kW)

HAP emission factors are from AP-42 (Sections 3.3 &amp; 3.4)

Load Factors are from Table 3.4 of the EPA Port Emissions Guidance Document

Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources)

| Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kWh) x (1 lb/454 g) x (1 ton/2000 lb) x (# of sources) |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------|------------------------|------------------------|--------------------------------|-----------|---------------------|----------------------------|------------------------------------|-------------|-----------------------------------|------------------|------|-----------------|------|------------------|-------------------|-----------------|------|
| Activity Type                                                                                                                                              | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                       | Count     | Duration (hrs/trip) | Operating Hours (per unit) | Assumptions                        | Load Factor | Auxiliary Engine Power Adjustment | Emissions (tons) |      |                 |      |                  |                   |                 |      |
|                                                                                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | NOx              | VOC  | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs |
| Construction Period - Activities beyond 25 Miles of the Project                                                                                            |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| Move jack up barge                                                                                                                                         | attendant tug                   | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 4 trips   | 4                   | 17                         |                                    | 0.31        | 1.100                             | 0.19             | 0.01 | 0.00            | 0.02 | 0.01             | 0.01              | 10.12           | 0.00 |
| Transport piles & transition pieces                                                                                                                        | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 86 trips  | 4                   | 375                        | avg. 3 piles per trip, 130 piles   | 0.68        | 1.100                             | 18.25            | 0.69 | 0.27            | 1.52 | 0.65             | 0.59              | 803.41          | 0.01 |
| Move scour installation equipment                                                                                                                          | attendant tug                   | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 4 trips   | 4                   | 17                         | This is done twice (once per year) | 0.31        | 1.100                             | 0.19             | 0.01 | 0.00            | 0.02 | 0.01             | 0.01              | 10.12           | 0.00 |
| Transport rock armor barges                                                                                                                                | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 276 trips | 4                   | 1,204                      | Spd. 8 knts                        | 0.68        | 1.100                             | 58.59            | 2.22 | 0.89            | 4.88 | 2.09             | 1.91              | 2857.23         | 0.03 |
| Transport filler material barges                                                                                                                           | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 370 trips | 4                   | 1,614                      | Spd. 8 knts                        | 0.68        | 1.100                             | 78.53            | 2.97 | 1.18            | 6.54 | 2.80             | 2.56              | 3843.75         | 0.04 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 155.8            | 5.9  | 2.3             | 13.0 | 5.6              | 5.1               | 7,625           | 0.1  |
| Emissions (tons)                                                                                                                                           |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| Activity Type                                                                                                                                              | Vessel Type/<br>Emission Source | Number of<br>Sources | Equipment<br>Size (HP) | Equipment<br>Size (kW) | Activity                       | Count     | Duration (hrs/trip) | Operating Hours (per unit) | Assumptions                        | Load Factor | Auxiliary Engine Power Adjustment | NOx              | VOC  | SO <sub>2</sub> | CO   | PM <sub>10</sub> | PM <sub>2.5</sub> | CO <sub>2</sub> | HAPs |
| Cable laying                                                                                                                                               |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| 1115 kV Cable laying barge                                                                                                                                 | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 4 trips   | 4                   | 17                         |                                    | 0.31        | 1.100                             | 0.10             | 0.00 | 0.00            | 0.01 | 0.01             | 0.01              | 5.06            | 0.00 |
| 33 kV Cable laying barge                                                                                                                                   | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 26 trips  | 4                   | 113                        | 13 round trips                     | 0.31        | 1.100                             | 0.63             | 0.02 | 0.00            | 0.05 | 0.03             | 0.03              | 32.88           | 0.00 |
| Move Crane barge to cofferdam location                                                                                                                     | tow tug                         | 1                    | 1,500                  | 1,119                  | Trips to/for Quonset Point, RI | 4 trips   | 4                   | 17                         |                                    | 0.31        | 1.100                             | 0.10             | 0.00 | 0.00            | 0.01 | 0.01             | 0.01              | 5.06            | 0.00 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 0.8              | 0.0  | 0.0             | 0.1  | 0.0              | 0.0               | 43              | 0.0  |
| Turbines                                                                                                                                                   | one specialized vessel          | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 86 trips  | 4                   | 375                        |                                    | 0.83        | 1.100                             | 22.38            | 0.84 | 0.34            | 1.86 | 0.79             | 0.73              | 1090.49         | 0.01 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 22.3             | 0.8  | 0.3             | 1.9  | 0.8              | 0.7               | 1,090           | 0.0  |
| ESP Installation                                                                                                                                           |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   |                  |      |                 |      |                  |                   |                 |      |
| Crane barge towing                                                                                                                                         | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 4                   | 9                          |                                    | 0.31        | 1.100                             | 0.10             | 0.00 | 0.00            | 0.01 | 0.01             | 0.01              | 5.06            | 0.00 |
| Pile Installation barge towing                                                                                                                             | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 4                   | 9                          |                                    | 0.31        | 1.100                             | 0.10             | 0.00 | 0.00            | 0.01 | 0.01             | 0.01              | 5.06            | 0.00 |
| ESP deck to wind farm                                                                                                                                      | tow tug                         | 1                    | 6,000                  | 4,474                  | Trips to/for Quonset Point, RI | 2 trips   | 4                   | 9                          |                                    | 0.68        | 1.100                             | 0.42             | 0.02 | 0.01            | 0.04 | 0.02             | 0.02              | 20.78           | 0.00 |
| Crane barge towing                                                                                                                                         | tow tug                         | 1                    | 3,000                  | 2,237                  | Trips to/for Quonset Point, RI | 2 trips   | 4                   | 9                          |                                    | 0.31        | 1.100                             | 0.10             | 0.00 | 0.00            | 0.01 | 0.01             | 0.01              | 5.06            | 0.00 |
| Subtotal                                                                                                                                                   |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 0.7              | 0.0  | 0.0             | 0.1  | 0.0              | 0.0               | 36              | 0.0  |
| TOTAL Construction Emissions Over 2-year Construction Duration                                                                                             |                                 |                      |                        |                        |                                |           |                     |                            |                                    |             |                                   | 179.6            | 6.8  | 2.7             | 15.0 | 6.4              | 5.9               | 8,794           | 0.1  |

• Quonset Point to 25-mile limit = 34.9 Miles

• Miles are nautical miles

A vessel speed of 8 knots was assumed to determine the duration for each trip

All operating hours will be metered to track actual emissions.