UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Model Clearinghouse review of an alternative model application of AERCOARE in conjunction with AERMOD in Support of Outer Continental Shelf PSD air permitting of the Park City Wind offshore wind power project

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INTRODUCTION

Vineyard Wind LLC has proposed the construction of an 804 MW offshore electric generation windfarm. Phase 1 of this windfarm project (Park City Wind) will consist of 50 to 62 wind turbine generators and 1 to 2 electrical service platforms installed on the Outer Continental Shelf (OCS) off of Martha's Vineyard, Massachusetts.[1] While the wind turbines and service platforms will not directly emit any NAAQS pollutants, there will be emissions of oxides of nitrogen (NO_X), an ozone precursor; carbon monoxide (CO); particulate matter (PM) with diameter 10 microns or less (PM_{10}); and PM with diameter 2.5 microns or less ($PM_{2.5}$) from diesel generators and other emitting equipment located on these devices and engines on vessels used during the construction and operations/maintenance phases of the project. Therefore, the Park City Wind project requires an OCS air permit and must comply with the requirements of EPA's Prevention of Significant Deterioration (PSD) program, which included the necessity to demonstrate compliance of the NAAQS and PSD Increments.

[1] The exact details regarding the number of wind turbine generators and electrical service platforms to be constructed in the Park City Wind project is currently unknown. A final revised modeling protocol with these details will be submitted to and reviewed by EPA Region 1. This revised modeling protocol will be based upon a "worst case" emissions scenario to ensure protection of the NAAQS and PSD Increments.

Vineyard Wind LLC has requested the use of the Coupled Ocean-Atmosphere Response Experiment (COARE) bulk flux algorithm, as implemented in the AERCOARE meteorological data preprocessor program to prepare meteorological data for use in the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) Modeling System in order to assess ambient impacts in a marine environment. For the Park City Wind project, the preferred nearfield dispersion model is the Offshore and Coastal Dispersion (OCD) model given its offshore location and potential for onshore impacts over coastal regions. So, the use of AERCOARE, in lieu of AERMET, and coupling with AERMOD is considered an alternative model application requiring EPA Regional Office approval with EPA's Model Clearinghouse concurrence per Section 3.2 of the *Guideline on Air Quality Models* (Appendix W to 40 CFR Part 51).[2]

BACKGROUND

On August 9, 2021, Vineyard Wind LLC submitted an alternative model justification package to EPA Region 1 requesting approval of a coupled AERCOARE-AERMOD approach for the compliance demonstration analysis required for the Park City Wind project.[3] The alternative model justification included ten technical reasons, options, and/or features available in the alternative model over those of the preferred model that are necessary to adequately demonstrate compliance in their permit application. Following the presumption that these ten technical reasons justified that the preferred OCD model was not appropriate for the Park City Wind project, Vineyard Wind LLC then provided detailed justification and/or explanation following the five elements of Condition 3 (Appendix W, Section 3.2.2(e)) required for alternative model justification and approval.

Prior to submitting an alternative model concurrence request to the Model Clearinghouse, EPA Region 1 conducted a thorough technical review of the Park City Wind alternative model proposal and request.[4] The Regional Office review found the proposed application of the alternative model for Park City Wind to be satisfactory under the requirements of Appendix W, Section 3.2.2(e) and consistent with previous EPA Regional Office alternative model concurrences and approvals for the use of the COARE algorithm with the AERMOD Modeling System. EPA Region 1 intends to approve the use of the coupled AERCOARE-AERMOD approach as an alternative model to conduct the compliance demonstration analysis for the Park City Wind project and is seeking concurrence for this alternative model approval from the Model Clearinghouse consistent with the requirements of Appendix W Section 3.2.2(a).

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[2] AERMET is the preferred meteorological preprocessor for AERMOD but is limited to only overland applications.

[3] The Park City Wind alternative model justification package is provided as reference material in the Model Clearinghouse Information Storage and Retrieval System (MCHISRS) record for this alternative model concurrence: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=22-I-01.

[4] The EPA Region 1 technical review document is provided as reference material in the MCHISRS record for this alternative model concurrence: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=22-I-01.

MODEL CLEARINGHOUSE REVIEW

The Vineyard Wind LLC AERCOARE-AERMOD alternative model request for the Park City Wind project is the third such request that the Model Clearinghouse has considered on the use of the COARE algorithm to appropriately characterize the marine boundary layer environment for dispersion modeling projects in the AERMOD Modeling System. In each case, the applicants have desired to use the more technically and scientifically advanced features of the AERMOD dispersion model to overcome limitations of the increasingly dated OCD model. However, the preferred use of AERMOD requires the use of AERMET as the meteorological preprocessor, and AERMET currently is limited to only overland applications. So, a suitable alternative to AERMET is necessary and must be fully justified.

For the Park City Wind project, the technical support documentation and justification provided by Vineyard Wind LLC and the technical review by EPA Region 1 for the use of the COARE algorithm in lieu of AERMET closely mirror a recent EPA Region 6 alternative model request/approval. In both the current EPA Region 1 and recent EPA Region 6 projects, the COARE algorithm is implemented through the meteorological data preprocessor program AERCOARE, which is coupled with AERMOD similarly to how AERMET couples with AERMOD. This provides an advantage for the implementation of the COARE algorithm for overwater meteorological processing and input into AERMOD over the offline process that was used in a previous EPA Region 10 alternative model request. [5]

In the Modeling Clearinghouse's assessment of EPA Region 1's technical review, we agree that there are five primary limitations (of the ten provided) that are most important to the Park City Wind project and the determination that the preferred OCD model is not the best compliance assessment tool for this situation. Specifically, EPA Region 1 highlights that:

(1) OCD does not provide for the multi-tiered screening approach for NO_2 modeling (specifically the Tier 2 or Tier 3 screening approaches);
(2) OCD does not contain options to generate outputs in the statistical forms consistent with current NAAQS;
(3) OCD does not account for calm wind conditions when calculating predicted pollutant concentrations;
(4) OCD cannot be used to model volume sources, and has a limited ability to model line sources; and
(5) OCD does not account for current advancements in dispersion theory. Namely, OCD determines dispersion parameters through the use of overwater-specific Pasquill-Gifford-Turner stability classes and prescribed curves based on stability class. As recognized in the preamble to the 2005 release of AERMOD[6], the model uses state-of-the-art

[5] Reference the following MCHISRS records for more information on the EPA Region 10 (May 2011) and EPA Region 6 (November 2019), alternative model concurrences: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=11-X-01.and https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=19-VI-01.

[6] US EPA (2005): Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose Dispersion Model and Other Revisions; Final Rule. 70 Fed. Reg. 68219.

formulations based on planetary boundary layer principals (Monin-Obukhov Similarity Theory) to determine dispersion parameters rather than the stability-class-based systems used in the replaced models.

In selecting a viable alternative to the OCD model, the alternative model must still address the fundamental formulation features of the preferred model. While the AERMOD Modeling System is technically and scientifically superior to OCD in numerous ways that will not be covered in this memorandum, it is noted that AERMOD does lack two formulation features that are often very important in overwater assessments, namely platform downwash and coastal fumigation. For the Park City Wind project, the modeling protocol will be based upon the use of the PRIME downwash algorithm, which will provide conservative results by treating the proposed platform structure as a solid versus porous structure and will extend the solid structure downward to the sea surface. Further, the Park City Wind project is located approximately 50 km offshore and all controlling concentrations are expected to occur at overwater receptors in the immediate/nearby vicinity of offshore structures and not closer to land when/where the impacts of coastal fumigation would become necessary to include in the assessment. Therefore, we agree that these two formulation features of OCD are not of significant concern or are resolved by a degree of additional conservatism with the use of the AERMOD Modeling System for the Park City Wind project.

The Model Clearinghouse would like to commend EPA Region 1 for an extremely thorough evaluation of the AERCOARE-AERMOD alternative model request for the Park City Wind project specific to the five elements of Condition 3 (Appendix W, Section 3.2.2(e)) required for alternative model justification and approval. We concur with EPA Region 1's assessment that the Appendix W alternative model requirements have been fully satisfied for the Park City Wind project. In an effort of brevity, we direct future readers of this concurrence response memorandum to Pages 6 through 15 of the EPA Region 1 technical review document for a complete presentation of each of the Condition 3 elements and the corresponding justification provided by Vineyard Wind LLC.[7]

We will highlight on Pages 11 and 12 that Vineyard Wind LLC and EPA Region 1 provide additional information and analysis to demonstrate the tracer studies used to develop the COARE algorithm are sufficiently representative of the marine environment off the coast of Massachusetts. This is an important supplement beyond any previous information provided in the EPA Region 10 or EPA Region 6 alternative model requests/approvals given that this is the first regulatory application of AERCOARE (COARE algorithm) in this offshore region of the US.

A final distinction to point out with the alternative model request for the Park City Wind project is the underlying meteorological data being used in the modeling demonstration. For Park City Wind, Vineyard Wind LLC is proposing to use WRF-MMIF prognostic data versus buoy observational data as the meteorological input data to the AERCOARE preprocessor. Considering that the COARE algorithm was originally developed using offshore buoy data, the

[7] https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=22-I-01.

use of prognostic data could introduce unintended and inappropriate biases into its application in a regulatory compliance demonstration. To alleviate such concerns, EPA Region 1 provided additional justification in their technical review and citation of a relevant 2015 EPA peer-reviewed report.[8] This report demonstrated that using meteorological inputs from WRF-MMIF performed similarly to AERCOARE-AERMOD modeling using measured data from buoys, in most scenarios. It is the assessment of EPA Region 1 that the use of WRF-MMIF data with AERCOARE-AERMOD does not result in systematic underpredictions of concentrations and is more likely to yield a more conservative conclusion. The Model Clearinghouse agrees with this assessment, notes that it is supported by Agency peer-reviewed research, and finds that it is consistent with Appendix W, Section 8.4.5 (Prognostic Meteorological Data, Discussion and Recommendations).

As noted above, this is the third alternative model request for the use of the COARE bulk flux algorithm in the AERMOD Modeling System given the overland-only limitations with the AERMET meteorological preprocessor. Based on the increasing need for near-field overwater compliance demonstration modeling, EPA is engaged in model development activities to replace the OCD model with AERMOD and to provide the means for processing overwater meteorology through AERMET, including updates to the MMIF prognostic meteorological data processor to appropriately process WRF model data for overwater applications. As a part of this model development effort, EPA has an ongoing Interagency Agreement with the Bureau of Ocean Energy Management (BOEM) focused on the incorporation of the platform downwash and coastal fumigation formulation capabilities into AERMOD.

MODEL CLEARINGHOUSE CONCURRENCE SUMMARY

In summary, the Model Clearinghouse fully concurs with EPA Region 1 proposed approval of a coupled AERCOARE-AERMOD approach for the compliance demonstration analysis required in the Park City Wind project based on the alternative model justification package provided by Vineyard Wind LLC and the technical review documentation provided by EPA Region 1. The Model Clearinghouse encourages EPA Region 1 to respond to Vineyard Wind LLC and to the docket for federal permitting actions related to the Park City Wind project with a letter of alternative model approval, as appropriate. The information associated with the EPA Region 1 alternative model approval and the Model Clearinghouse concurrence should be available for comment during the appropriate public comment period(s).

Given the possible importance of platform downwash and shoreline fumigation, the Model Clearinghouse recommends caution and careful review before additional alternative model considerations of the coupled AERCOARE-AERMOD approach in other projects. As similarly stated in the respective EPA Region 6 and EPA Region 10 concurrence responses, this case-specific Model Clearinghouse concurrence does not constitute a generic approval of a coupled AERCOARE-AERMOD approach for other applications elsewhere. However, the scope of the technical assessment submitted with the EPA Region 1, EPA Region 6, and EPA Region 10

[8] U.S. EPA (2015): Combined WRF/MMIF/AERCOARE/AERMOD Overwater Modeling Approach for Offshore Emission Sources, Vol. 2. EPA 910-R-15-001b, October 2015.

Model Clearinghouse alternative model requests continue to provide a good basis for such considerations.

For any future projects considering the use of a coupled AERCOARE-AERMOD approach, early consultation with the appropriate reviewing authority and EPA Regional Office is strongly recommended. The Model Clearinghouse also notes that there may be other possible alternative model pathways using prognostic meteorological data (*e.g.*, WRF via the MMIF meteorological preprocessor) for projects in marine environments. No matter the pathway, any alternative model application other than the preferred OCD model approach for a similar project requires EPA Regional Office approval with Model Clearinghouse concurrence per Appendix W, Section 3.2.

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