Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Investigating Shoreline Fumigation Algorithms in Offshore and Coastal Dispersion Model for AERMOD – Part 2 of the U.S. Environmental Protection Agency's Interagency Agreement to Improve AERMOD for Overwater Applications (NT-23-07)
Administered by	Office of Environmental Programs
BOEM Contact(s)	Stacie Merritt (stacie.merritt@boem.gov)
Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	US Environmental Protection Agency
Total BOEM Cost	$500,000
Performance Period	FY 2023–2026
Final Report Due	September 30, 2026
Date Revised	August 29, 2024
Problem	BOEM needs to replace the Offshore and Coastal Dispersion (OCD) model with AERMOD, USEPA's preferred dispersion model for overland. However, AERMOD does not have the necessary algorithms to treat plume downwash effects caused by offshore platforms and plume fumigation that can occur at the shoreline. Modeling is one approach that BOEM uses to determine possible air quality impacts caused by Outer Continental Shelf (OCS) oil and gas activities, as required under the National Environmental Policy Act (NEPA) and the Outer Continental Shelf Lands Act (OCSLA). BOEM needs to continue current work to incorporate a platform downwash algorithm into AERMOD and add necessary shoreline fumigation algorithms to achieve this goal.
Intervention	The older offshore dispersion model, OCD, has aspects that are outdated. An effort to integrate the platform downwash algorithm from OCD into AERMOD has been ongoing with results currently preliminary and additional refinements being needed. A scoping study to identify and assess existing shoreline fumigation formulations and algorithms is currently ongoing and includes a review of the shoreline fumigation algorithms in existing models, including OCD. The results of the scoping study need review with a determination of a path forward to add shoreline fumigation to AERMOD. A possible path of integrating shoreline fumigation from OCD would require AERMOD to be re-coded to include two meteorological streams (overland and overwater) and include a mechanism for identifying the location of the shoreline relative to the source, but this path has not yet been decided.
Comparison	Current wind tunnel studies funded by BOEM are being used to test, evaluate, and refine platform downwash algorithms and integrate them into AERMOD as a state-of-the science dispersion model. Though there are limited field study databases to fully evaluate the updated model, intercomparisons of OCD and AERMOD, with platform downwash added, would be run post-installation of shoreline fumigation which could be a method to validate the shoreline

	fumigation. However, other methods of validation and data availability will need to be explored.
Outcome	Having the necessary platform downwash and shoreline fumigation algorithms in AERMOD are steps that are necessary for the USEPA to replace OCD with AERMOD through regulatory action for use in BOEM applications. In 30 CFR 550, operators are required to use USEPA's Guideline on Air Quality Models (published as Appendix W to 40 CFR Part 51), thus BOEM needs to support USEPA's efforts to complete the steps required to replace OCD with AERMOD.
Context	Gulf of Mexico

BOEM Information Need(s): The USEPA has listed AERMOD as a preferred overland dispersion model in its Guideline on Air Quality Models (published as Appendix W to 40 CFR Part 51). AERMOD does not have the necessary platform downwash and shoreline fumigation algorithms required for many overwater applications. The older OCD dispersion model treats both platform downwash and shoreline fumigation, which are scientifically sound, but other aspects of OCD are outdated, such the inability to use current operating systems, outdated post-processing routines that do not conform with current National Ambient Air Quality Standards (NAAQS) averaging times, and limits on the number of sources and receptors that can be represented in a single model run. BOEM needs to continue current work to incorporate a platform downwash algorithm into AERMOD and add necessary shoreline fumigation algorithms into AERMOD to achieve this goal. A possible path of integrating shoreline fumigation from OCD would also require AERMOD to be re-coded to include two meteorological streams (overland and overwater) and include a mechanism for identifying the location of the shoreline relative to the source.

Background: The 1990 Clean Air Act Amendments requires the USEPA to set the NAAQS for widespread pollutants from numerous and diverse sources considered harmful to public health and the environment. OCSLA states that OCS oil and gas exploration, development, and production activities cannot significantly impact the NAAQS compliance of any state. Modeling is one application that BOEM determines possible air quality impacts caused by OCS oil and gas activities as required under NEPA and OCSLA. BOEM's regulations at 30 CFR 550 require that modeling must be conducted according to the guidelines of the USEPA's Appendix W. Having necessary shoreline fumigation algorithms in AERMOD is one step BOEM needs to replace the outdated OCD, according to the USEPA through discussions of IWAQM-Overwater and the USEPA's White Paper (USEPA 2022).

Shoreline fumigation (Figure 1) is the condition when offshore emissions intersect the thermal internal boundary layer that forms onshore; causing an otherwise elevated plume to mix down to the ground within this layer resulting in increased ground-level concentrations onshore.

The current offshore dispersion model, OCD, has both platform downwash and shoreline fumigation algorithms, which are of sound science, but OCD has not been updated in 20 years. BOEM needs to replace OCD with AERMOD, USEPA's preferred near-field dispersion model for overland applications. However, AERMOD does not have the necessary platform downwash and shoreline fumigation algorithms. An effort to integrate the platform downwash algorithm from OCD into AERMOD has been ongoing with results currently preliminary and additional refinements being needed. A scoping study to identify and assess existing shoreline fumigation formulations and algorithms is currently ongoing and includes a review of the shoreline fumigation algorithms in OCD. The results of the scoping study need review with a determination of a path forward to add shoreline fumigation to AERMOD. A possible path of integrating shoreline fumigation from OCD would also require AERMOD to be re-coded to include two

meteorological streams (overland and overwater) and include a mechanism for identifying the location of the shoreline relative to the source.

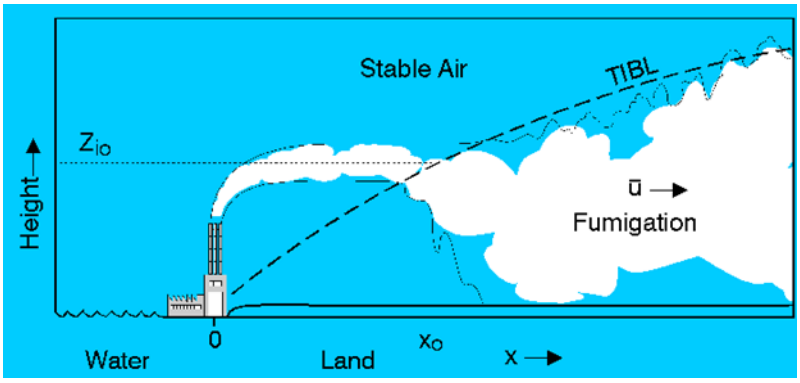

Figure 1. Shoreline fumigation (CSIRO 2008).

This study would tie into the ongoing BOEM IA with USEPA, IA Number M19PG00019 (GM-19-x05), which started the necessary improvements needed in AERMOD for offshore applications (to replace OCD) by incorporating the OCD platform downwash algorithms into AERMOD. This study would be a continuation of this effort (and USEPA IA) to refine and further evaluate the platform downwash algorithm now implemented into AERMOD and implementing a shoreline fumigation algorithm into AERMOD.

Objective(s): The objectives of the study are to refine and further evaluate the OCD platform downwash algorithm that has been installed into AERMOD and add shoreline fumigation algorithms into AERMOD.

Methods: This study would consist of:

1. Further evaluation of the platform downwash algorithm and to make refinements as needed to meet the criteria of Appendix W as a preferred model.
2. Review of the ongoing IA's shoreline fumigation scoping study.
3. Determine the best fit path forward to incorporate shoreline fumigation into AERMOD (USEPA has determined there are multiple potential paths forward).
4. Draft and finalize shoreline fumigation coding into AERMOD (including the incorporation of two meteorological streams if required, based on the development pathway selected).
5. Complete model intercomparisons and model evaluations.

Specific Research Question(s):

1. What is the best approach to incorporate shoreline fumigation into AERMOD?
2. For the more appropriate solution, what are the meteorological data needs and what updates will need to be made to AERMET and/or AERMOD?
3. How does the newly formed shoreline fumigation algorithm in AERMOD compare to OCD shoreline fumigation algorithm?
4. Are there limitations in the applicability of fumigation algorithms not previously seen in scientific literature?

Current Status: The platform downwash algorithm from OCD has been integrated into a version of AERMOD under a current Interagency Agreement. USEPA released the integration as completed under the current Interagency Agreement as an alpha option in AERMOD (version 22112) in the late spring of 2022. Preliminary results indicate under prediction when evaluated against recent wind tunnel studies performed by CPP Wind Engineering & Air Quality Consultants under contract with BOEM. Additional evaluation is needed with refinements to the implementation. A scoping study on shoreline fumigation is ongoing under the current Interagency Agreement.

Publications Completed: None

Affiliated WWW Sites: None

References:

[CSIRO] Commonwealth Scientific and Industrial Research Organisation. 2008. The Kwinana coastal fumigation study. Canberra (Australia): Commonwealth Scientific and Industrial Research Organisation; [accessed 2022 May 4]. http://www.cmar.csiro.au/e-print/open/sawford_1997a.html

[USEPA] U.S. Environmental Protection Agency. 2022. AERMOD modeling system updates related to overwater modeling applications. Washington (DC): U.S. Environmental Protection Agency; [accessed 2022 May 4]. https://www.epa.gov/sites/default/files/2021-01/documents/overwater_white_paper.pdf