

## Environmental Studies Program: Ongoing Study

Field	Study Information
Title	
Administered by	New Orleans Office
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Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	Environmental Protection Agency (EPA)
Performance Period	FY 2025–2028
Final Report Due	September 1, 2028
Date Revised	February 23, 2026
Problem	BOEM needs updated photochemical modeling to evaluate air quality impacts from Outer Continental Shelf (OCS) oil and gas activities in the Gulf of America to support BOEM's leasing program, environmental impact statements, and National Ambient Air Quality Standards (NAAQS) compliance demonstrations.
Intervention	Enhance current EPA efforts with resources from BOEM to develop a photochemical modeling platform for the Gulf of America. Photochemical models have been recognized and routinely used for regulatory air quality assessments. EPA has an existing modeling platform for 2022 with existing meteorological simulations, national emission inventory data, and other data that can be augmented using BOEM's resources (updated offshore emission inventory data) to obtain finer-scale modeling data specific to the Gulf of America.
Comparison	The ambient air concentrations from different OCS oil and gas scenarios will be estimated with sophisticated photochemical models and newly developed screening tools. The air quality value results from the screening tools will be compared to appropriate significance level values and NAAQS levels.
Outcome	Modeled ambient air concentrations from different OCS oil and gas scenarios and developed screening tools to address air quality impacts to support BOEM's leasing program, environmental impact statements, and NAAQS compliance demonstrations.
Context	Gulf of America

BOEM Information Need(s): BOEM needs updated air quality photochemical modeling (including meteorological modeling) to evaluate air quality impacts from OCS oil and gas activities in the Gulf of America to support the requirements in the Outer Continental Shelf Lands Act (OCSLA) and the National Environmental Policy Act (NEPA). Photochemical models have been recognized and routinely used for regulatory air quality assessments. Photochemical models are necessary to analyze pollutants under the National Ambient Air Quality Standards (NAAQS) such as ozone and particulate matter, as opposed to air dispersion models that do not incorporate important chemical processes. The modeled ambient air concentrations would be processed and compared to applicable standards such as the National Ambient Air Quality Standards (NAAQS) for all areas. Furthermore, screening tools will be developed to assess air

quality impacts relevant for OCS oil and gas plan and permit applicants to optionally use to support plan and permit related programs and cumulative assessments related to lease sales, where these tools would allow comparison of air quality values to appropriate significance level values and NAAQS levels.

Background: BOEM completed an Air Quality Modeling in the Gulf of Mexico Region study (OCS Study BOEM 2019-057) in 2019, however, the information is dated. The Air Quality Modeling in the Gulf of Mexico Region study performed meteorological modeling using the Weather Research and Forecasting (WRF) model to support the air quality modeling for calendar years 2010-2014. Also, the Air Quality Modeling in the Gulf of Mexico Region study completed modeling for various single lease sale scenarios from the 2017-2022 Gulf of Mexico Multisale Environmental Impact Statement. This study will provide updated air quality modeling using the latest emission inventories and emission estimates from single lease sale scenarios to support BOEM's leasing program and environmental impact statements, updated meteorological data to be used by external stakeholders in air dispersion modeling reports for oil and gas plans, and screening tools to support OCS oil and gas plan and permit related programs and cumulative assessments related to lease sales. The screening tools would allow comparison of air quality values to appropriate significance level values and NAAQS levels.

The areas of possible influence for this study include the states of Texas, Louisiana, Mississippi, Alabama, and Florida and national parks and wilderness Class I and II areas (Breton Wilderness, Padre Island National Seashore, and Gulf Islands National Seashore).

#### Objectives:

1. Development of meteorological model inputs for dispersion models to support OCS oil and gas plan and permit demonstrations in the Gulf of America.
2. Development of a high-resolution photochemical modeling platform for the Gulf of America and provide results that will support analysis of future OCS oil and gas activity lease sale scenarios, facilitate comparisons with applicable NAAQS, and include enhanced features including source apportionment to inform screening tool development for OCS oil and gas plan and permit program related demonstrations.
3. Development of screening tools to assess the impacts of single sources for air quality impacts relevant for OCS oil and gas plan and permit applicants to optionally use to support plan and permit related programs and cumulative assessments related to lease sales, where these tools would allow comparison of air quality values to appropriate significance level values and NAAQS levels.
4. (Optional) Examine how well the modeling system captures meteorological conditions and processes in the Gulf of America related to elevated levels of air pollution using special field measurements and satellite products.

Methods: This project would collaborate with the Environmental Protection Agency (EPA) and leverage ongoing work to develop a new photochemical modeling platform representing 2022. Since the EPA already has existing WRF simulations and national emission inventory data for the Continental U.S. for 2022, using EPA's data helps reduce costs. That EPA effort would be augmented with resources from BOEM (such as updated emission inventory data and lease sale scenarios) to add a finer resolution (~4 km) model domain over the Gulf of America to best represent meteorology, offshore emissions, and the complex land-water interface. Model contribution from OCS oil and gas sources output from that finer resolution modeling would be processed in a way that is consistent with EPA's Guideline on Air Quality

Models (Appendix W to 40 CFR Part 51) and other relevant permit program modeling guidance. The project would additionally involve funding from BOEM to conduct meteorological modeling with the Weather Research and Forecasting Mesoscale Model (WRF) for two more annual fine-scale (~4 km) simulations in addition to 2022. These additional WRF simulations will leverage new WRF data generated by EPA with a 12 km grid. All the WRF output data will be evaluated for use over the Gulf of America and used to make inputs for the photochemical grid modeling. Further, all three years of WRF output would be used to develop the mesoscale model interface (MMIF) files for air dispersion modeling. Wilson et al. (2019) generated meteorological data for WRF and MMIF and are provided at <https://boem.gcoos.org/>. These meteorological files would replace the existing files.

BOEM resources will support photochemical grid modeling for the fine scale (4 km) domain over the Gulf of America for 2022. This photochemical model application will include source apportionment for specific OCS sources and/or defined OCS source regions to estimate contribution to model predicted O<sub>3</sub>, secondary PM<sub>2.5</sub>, primary PM<sub>2.5</sub> at distances greater than 50 km, and other air pollutants. A comprehensive air emission inventory would be developed using EPA's existing data added with BOEM's resource, offshore emission inventories, to depict emissions within the study area for a low, mid, and high impact using the base case (ongoing scenario), single lease sale plus base case, and future year scenario (cumulative scenario with and without the single lease sale) to support photochemical grid modeling. Photochemical grid modeling would be conducted to examine the potential air quality impacts of a low, mid, and high single sale scenario representative of a typical oil and gas lease sale for the Gulf of America. The baseline photochemical model simulation will be processed and compared with routine surface measurement network data to support an operational model evaluation. The modeled ambient air concentrations would be processed and compared to applicable standards such as the NAAQS and Air Quality Related Values (AQRVs). Select air toxins (i.e., hazardous air pollutants) would also be modeled and, when possible, compared to any standards. Core model products developed with BOEM funding leveraging EPA modeling efforts: 1) annual 4 km WRF simulations for 2022, 2023, and 2024; 2) annual 4 km photochemical grid modeling simulation for 2022; 3) annual 4 km photochemical grid model simulation for 2022 with source apportionment to track specific OCS sources and/or source regions in the Gulf of America and to develop multiple screening tools for estimating air quality impacts from these types of sources; 4) annual 4 km MMIF output files for dispersion model applications for 2022, 2023, and 2024; and 5) WRF and photochemical model baseline model performance (for 2022) technical support document.

Other task(s) (objective addressed in number 4) may include addressing uncertainties in emission inventories and provide more complex diagnostic model evaluation using routine surface measurements, satellite data, and available special measurements made as part of relevant field studies like (but not limited to) the airborne air emission surveys of OCS oil and gas activities and the NASA's SCOAPE II work. The objective addressed in number 4 is optional and will depend on, but not limited to, progress of other tasks and available information from other studies to be able to complete this work. The primary objective of this phase is to examine how well the modeling system captures meteorological conditions and processes in the Gulf of America related to elevated levels of PM<sub>2.5</sub> and O<sub>3</sub> (and if possible, other air pollutants) using special field measurements made as part of field studies. Further, additional evaluation will be done to determine how well the model captures PM<sub>2.5</sub>, O<sub>3</sub>, and important precursors and intermediate chemical compounds in the Gulf of America using measurements made as part of special field studies (e.g., SCOAPE 2019 and 2024) and if feasible satellite products (e.g., TEMPO, TROPOMI, etc.). As part of these evaluation efforts consideration will be made to better understand how emissions inventories (criteria air pollutants and precursors) for sources in the Gulf of America can be evaluated and improved through airborne measurements and satellite products.

Current Status: This study was initiated under an Interagency Agreement with the EPA. The kickoff meeting has been completed, and work on Task 1 is underway. EPA will produce 5-year WRF and MMIF meteorological datasets for the Gulf of America.

Publications Completed:

Wilson D, Stoeckenius T, Brashers B, Do B. 2019. Air quality modeling in the Gulf of Mexico Region. New Orleans (LA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 655 p. Report No.: OCS Study BOEM 2019-057.

National Academies of Sciences, Engineering, and Medicine. 2019. Review of the Bureau of Ocean Energy Management "air quality modeling in the Gulf of Mexico region" study. Washington (DC): The National Academies Press. <https://www.nap.edu/catalog/25600/review-of-the-bureau-of-ocean-energy-management-air-quality-modeling-in-the-gulf-of-mexico-region-study>.

Affiliated WWW Sites: N/A

References:

Wilson D, Stoeckenius T, Brashers B, Do B. 2019. Air quality modeling in the Gulf of Mexico Region. New Orleans (LA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 655 p. Report No.: OCS Study BOEM 2019-057.