Field	Study Information
Title	Arctic Air Quality Modeling on the North Slope of Alaska (AK-26-04)
Administered by	Office of Environmental Programs
BOEM Contact(s)	Holli Wecht (holli.wecht@boem.gov)
Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	Environmental Protection Agency (EPA)
Total BOEM Cost	TBD
Performance Period	FY 2026–2029
Final Report Due	TBD
Date Revised	March 27, 2025
Problem	BOEM needs updated photochemical modeling to evaluate air quality impacts from Outer Continental Shelf (OCS) oil and gas activities on the North Slope Borough of the State of Alaska (Alaska Region) 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 Alaska Region. Photochemical models have been recognized and routinely used for regulatory air quality assessments. EPA has an existing modeling platform for 2022 with required 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 Alaska Region.
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 with 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	Alaska Region

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 on the North Slope Borough of the State of Alaska (Alaska Region), which includes the Beaufort Sea and Chukchi Sea Planning Areas, 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 analyzed 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 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 *Arctic Air Quality Modeling Study* in 2018, which included these published reports:

- Arctic Air Quality Modeling Study: Emissions Inventory – Final Task Report (OCS Study BOEM 2014-1001)
- Arctic Air Quality Modeling Study Meteorological Model Performance Evaluation: 2009-2013 BOEM Arctic WRF Dataset (OCS Study BOEM 2015-049)
- Arctic Air Quality Modeling Study – Final Photochemical Modeling Report (OCS Study BOEM 2016-076)
- Arctic Air Quality Modeling Study- Final Near-Field Dispersion Modeling Report (OCS Study BOEM 2017-029)
- Arctic Air Quality Modeling Study- Evaluation of the Emissions Exemption Thresholds (OCS Study BOEM 2017-040)
- Arctic Air Quality Impact Assessment Modeling Study: Final Project Report (OCS Study BOEM 2018-020)

This information is dated since the study performed meteorological modeling using the Weather Research and Forecasting (WRF) model to support the air quality modeling for calendar years 2009-2013 and the study completed modeling for base year 2012 and projected future year using two sites in Chukchi Sea and four sites in Beaufort Sea. 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 includes the state of Alaska and national parks and wilderness Class I areas (Denali National Park, Bering Sea Wilderness Area, Tuxedni Wilderness Area, and Simeonof Wilderness Area).

Objective(s):

1. Development of meteorological model inputs for dispersion models to support OCS oil and gas plan and permit demonstrations in the Alaska Region.
2. Development of a high-resolution photochemical modeling platform for the Alaska Region 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.

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 (3 km) model domain over the Alaska Region to best represent meteorology, offshore emissions, and the complex land-water interface. Model contribution from OCS oil and gas sources and 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 WRF for two more annual fine-scale (3 km) simulations in addition to 2022 (i.e., 2023 and 2024). These additional WRF simulations will leverage new WRF data generated by EPA that covers Alaska with a 9 km grid. All the WRF output data will be evaluated for use over the Alaska Region and used as 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.

BOEM resources will support photochemical grid modeling for the fine scale (3 km) domain over the Alaska region 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 ozone (O3), secondary fine particulate matters (PM2.5), primary PM2.5 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 Alaska Region. 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 include: 1) annual 3 km WRF simulations for 2020, 2022, and 2023; 2) annual 3 km photochemical grid modeling simulation for 2022; 3) annual 3 km photochemical grid model simulation for 2022 with source apportionment to track specific OCS sources and/or source regions in the Alaska Region and to develop multiple screening tools for estimating air quality impacts from these types of sources; 4) annual 3 km MMIF output files for dispersion model applications for 2020, 2022, and 2023; and 5) WRF and photochemical model baseline model performance (for 2022) technical support document.

Specific Research Question(s):

1. Do the emissions from offshore oil and gas activities significantly impact the air quality of any State?

2. At what emissions level does an offshore plan on the North Slope Borough of the State of Alaska impact the onshore air quality?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References: None