

Environmental Studies Program: Ongoing Study

Field	Study Information
Title	GOMR Coastal Ambient Air Quality Monitoring Program: A Pilot Study (GM-19-03)
Administered by	Gulf of Mexico OCS Region
BOEM Contact(s)	Cholena Ren (cholena.ren@boem.gov)
Procurement Type(s)	Contract
Conducting Organization(s)	Ambilabs
Total BOEM Cost	\$995,345.89
Performance Period	FY 2019–2023
Final Report Due	September 2025
Date Revised	October 17, 2023
Problem	Concentration measurements of criteria air pollutants and their precursors are lacking at the northern Gulf of Mexico's coast.
Intervention	Criteria air pollutant concentrations and their precursors will be measured and monitored at a site located in Grand Chenier, Louisiana.
Comparison	Observed criteria pollutants will be compared to BOEM's air quality model predictions and to the National Ambient Air Quality Standards.
Outcome	Use the criteria air pollutant concentrations to determine if concentrations are below or above the National Ambient Air Quality Standards and evaluate BOEM's air quality modeling results.
Context	Central Gulf of Mexico, Western Gulf of Mexico

BOEM Information Need(s): BOEM needs to determine if activities authorized under the Outer Continental Shelf Lands Act (OCSLA) complies with National Ambient Air Quality Standards (NAAQS). OCSLA, under section 5(a)(8), requires compliance with the NAAQS pursuant to the Clean Air Act (42 U.S.C. 7401 et. seq.).

Background: The 1990 Clean Air Act Amendments (CAAA) requires the U.S. Environmental Protection Agency (USEPA) to set the National Ambient Air Quality Standards (NAAQS) for common air pollutants considered harmful to public health and the environment. The CAAA requires the USEPA to review the NAAQS periodically to ensure they provide adequate health and environmental protection, and to update those standards as necessary. The USEPA has set NAAQS for the following six criteria air pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM), and sulfur dioxide (SO₂). The current levels of the NAAQS are listed at: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>. Furthermore, the precursor pollutants are also important to consider when examining how the precursors contribute to a criteria air pollutant level. For example, photochemical reactions between volatile organic compounds (VOCs) and nitrogen oxides (NO_x) can lead to the formation of O₃ (Atkinson, 2003). Finally, meteorological conditions assist in understanding air pollutant transport and dispersion.

Onshore areas are designated as nonattainment, attainment/unclassifiable or unclassifiable areas. Non-attainment areas do not comply with the NAAQS, whereas attainment areas do comply with the NAAQS. Unclassifiable areas do not have sufficient data to determine the attainment status of the area. Air quality monitors are mostly located in nonattainment areas. Air quality monitoring data assists the USEPA to determine these designations and States are responsible for managing a network of air quality monitoring stations for criteria air pollutants and their precursors. Though the Bureau of Ocean Energy Management (BOEM) does not have air quality jurisdiction onshore, BOEM does have air quality jurisdiction in the Gulf of Mexico Outer Continental Shelf (OCS) of the Central and Western Gulf of Mexico planning areas. BOEM's activities authorized under the Outer Continental Shelf Lands Act (OCSLA) require activities to comply with the NAAQS pursuant to the CAAA to the extent that activities significantly affect the air quality of any State. Therefore, additional coastal air quality monitoring stations will help BOEM gain a better understanding of offshore air pollutant transport and its impacts.

Air quality monitoring data currently available and provided by the federal, state, local, and tribal agencies do not fulfill completely BOEM's needs. In addition, most monitoring stations are located in urban areas with a high population density or near a high emitting onshore point source. Thus, BOEM wants to conduct a pilot study to assess the need to expand the spatial and temporal monitoring coverage onshore in the coastal areas of the Gulf States. The meteorological and air quality monitoring data will assist BOEM in evaluating modeling predictions from the *Air Quality Modeling in the Gulf of Mexico* study and future modeling studies, establish background concentrations to demonstrate compliance with the NAAQS in OCS plans, and examine long-term regional trends (Wilson, 2019). This pilot study is to help to determine whether BOEM needs an expanded study and to make recommendations for any future expanded studies. BOEM needs updated air pollutant monitoring to validate modeling studies and NASA satellite images, establish background concentrations, and examine offshore impacts and trends (Thompson, 2020).

As reported in the *2014 Gulfwide Emission Inventory Study* (OCS Study BOEM 2017-044), oil and gas sources have negligible Pb emissions, thus this study will not monitor for Pb (Wilson, 2017). However, it is of interest to monitor O₃ because the *Air Quality Modeling in the Gulf of Mexico* study was limited on O₃ monitors within the 4 km modeling domain and additional measurements. Therefore, placing O₃ monitors within the 4 km domain of the modeling study would expand O₃ data to improve the validation of future modeling results. Also, understanding concentrations of NO₂ is of interest as NO₂ is the highest emitting pollutant in OCS plans. By measuring photolysis of NO₂ and NO_y (total reactive oxides of nitrogen species), it will help to understand the sources causing active NO₂ and O₃ formation episodes and variability of BOEM's modeling results from the *Air Quality Modeling in the Gulf of Mexico* study (Osthoff, 2008; Pechtl, 2007; Thornton, 2010; Wilson, 2019).

Federal monitoring must comply with the requirements outlined in 40 Code of Federal Regulations (CFR) part 58. A quality management plan (QMP) and quality assurance project plan (QAPP) are required when federal, state, and local government agencies plan to use the data for compliance purposes. The QMP addresses roles and responsibilities and the QAPP explains the monitoring strategy to assure the quality of the project's data. Standard operating procedures (SOPs) must also be involved for sampling and analytical procedures. The QMP, QAPP, and meteorological and air pollutant concentration data are reported to Air Quality System (AQS). The AQS data supports attainment and nonattainment designations; therefore, the data could support State agencies in their State Implementation Plans (SIPs). In addition, the AirData Air Quality Monitors App supported by the USEPA retrieves data from AQS and puts it in a more user-friendly system that is accessible to the public.

In addition, placement of a Pandora spectrometer measuring total column (TC) NO₂ in the Louisiana coastal monitoring station would (1) allow a comparison between that data and satellite collected TC NO₂ data, (2) contribute to the ongoing improvements in the Ozone Monitoring Instrument (OMI) and the still evolving TROPOMI, and (3) will further the understanding of chemical transformations in the boundary layer. This additional data can help BOEM better understand the feasibility of using satellite data to measure air quality offshore.

Objectives: This study will evaluate the feasibility of a coastal air quality monitoring study and provide recommendations to design an expanded study.

Methods: This project has developed a quality management plan (QMP) and quality assurance project plan (QAPP) for compliance purposes. The QMP, QAPP, and meteorological and air pollutant concentration data will be reported to the Air Quality System (AQS). A risk mitigation plan to minimize risks from severe weather was developed and will be implemented as needed. The project involved building one mobile monitoring station designed to measure meteorological conditions for wind speed and direction, differential temperatures, relative humidity, and barometric pressure and pollution concentrations for O₃, trace levels of NO₂, NO_y, trace levels of CO, jNO₂ (nitrogen dioxide photolysis rate) for a period of 3 years and measure air column NO₂ for at least 1 1/2 years. Pandora spectrometer TC NO₂ data will be reported through the Pandora Global Network, a joint effort by NASA and European Space Agency (ESA).

Specific Research Question(s):

1. What are the air pollutant concentrations for NO₂ and O₃ and their precursors?
2. Are the measured criteria air pollutants above or below the NAAQS? If above the NAAQS, do the meteorological conditions indicate if impacts occurred from offshore sources?
3. What is the accuracy and variability of BOEM's modeling results from the *Air Quality Modeling in the Gulf of Mexico* study based on the data supplied by this study and existing monitoring data?
4. Are there any correlations between the meteorological conditions and air pollutant concentration data, long-term trends, and temporal and spatial data supplied from this study and existing monitoring data?

Current Status: Operation of the monitoring station began on September 30th, 2021.

Publications Completed: None

Affiliated WWW Sites: None

References:

- Atkinson R, Arey J. 2003. Atmospheric degradation of volatile organic compounds. Chem. Rev. 103:4605–4638. <https://doi.org/10.1021/cr0206420>.
- 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. Gulf of Mexico Region. 655 p. Report No.: OCS Study BOEM 2019-057.

- Thompson AM. 2020. Evaluation of NASA's remote-sensing capabilities in coastal environments. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 33 p. Report No.: OCS Study BOEM 2020-047.
- Wilson D, Billings R, Chang R, Enoch S, Do B, Perez H, Sellers J. 2017. Year 2014 gulfwide emissions inventory study. New Orleans (LA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 275 p. Report No.: OCS Study BOEM 2017-044.
- Osthoff HD, Roberts JM, Ravishankara AR, Williams EJ, Lerner BM, Sommariva R, Bates TS, Coffman D, Quinn PK, Dibb JE. et al. 2008. High levels of nitryl chloride in the polluted subtropical marine boundary layer. *Nat. Geosci.* 1:324–328. <https://doi.org/10.1038/ngeo177>.
- Pechtl S, von Glasow R. 2007. Reactive chlorine in the marine boundary layer in the outflow of polluted continental air: a model study. *Geophys. Res. Lett.* 34:L11813. <https://doi.org/10.1029/2007GL02976>.
- Thornton JA, Kercher JP, Riedel TP, Wagner NL, Cozic J, Holloway JS, Dubé WP, Wolfe GM, Quinn PK, Middlebrook AM, et al. 2010. A large atomic chlorine source inferred from mid-continental reactive nitrogen chemistry. *Nature*. 464:271–274. <https://doi.org/10.1038/nature08905>.