Field	Study Information
Title	Airborne Air Emission Surveys of Oil and Gas Activities in the Gulf of Mexico Region (GM-25-03)
Administered by	Gulf of Mexico Region
BOEM Contact(s)	Cholena Ren (cholena.ren@boem.gov)
Procurement Type(s)	Interagency Agreement
Performance Period	FY 2025–2028
Final Report Due	TBD
Date Revised	April 5, 2024
Problem	BOEM needs basin to facility scale airborne air emission surveys to assess air quality impacts from oil and gas activity activities in the Gulf of Mexico (GOM) and to address potential data gaps in BOEM's emission inventories used for NEPA.
Intervention	Collaborate with NOAA to extend their existing multi-aircraft campaign to take airborne measurement surveys offshore in the GOM.
Comparison	The quantified emissions would be compared to newly launched satellite sensors for monitoring and measuring methane emissions (e.g., MethaneSat, Carbon Mapper) and other air emission data products, when possible. Also, the field measurements may be used to examine how well the modeling system capture meteorological conditions and processes in the GOM.
Outcome	Quantification of basin and/or facility scale emissions on a limited set of air pollutants in the GOM.
Context	Western GOM, Central GOM

BOEM Information Need(s): BOEM has jurisdiction over Outer Continental Shelf (OCS) air emissions in the GOM west of 87.5 degrees West longitude on a limited set of air pollutants. Oil- and gas-related activities authorized under the Outer Continental Shelf Lands Act (OCSLA) must comply with the National Ambient Air Quality Standards (NAAQS). This study supports BOEM's ability to monitor air emissions over the OCS, improve quantification of air emissions, and work towards assessing the impact of regulated air emissions and those not controlled by regulation. BOEM needs to evaluate its emission inventory and quantify the associated uncertainties to fully characterize the impact of its oil and gas activities in the GOM.

Background: The NAAQS cover six common criteria air pollutants (carbon monoxide [CO], lead [Pb], nitrogen dioxide [NO_2], ozone [O_3], particulate matter [PM], and sulfur dioxide [SO_2]) that are considered harmful to the public. Hazardous air pollutants and pollutant greenhouse gas types are also considered harmful to the public (USEPA 2024; USEPA 2009). Oil and gas operators in the GOM are required to report to BOEM's emission inventory, the Outer Continental Shelf Air Quality System (OCS AQS). OCS AQS estimates air emissions from routine oil and gas activities, but the air emissions are not monitored and measured. It has been demonstrated there are uncertainties in OCS AQS (Gorchov Negron et al.

2023). BOEM can collaborate with the Bureau of Safety and Environmental Enforcement (BSEE) risk-based inspection program as a supplemental approach to effectively use resources to survey near high-risk facilities with an air quality focus (BSEE 2019). Quantification of air emissions can be completed near the high-risk facilities and then $PM_{2.5}$, O_3, and other important precursors and intermediate chemical compounds can be examined in the photochemical modeling by the U.S. Environmental Protection Agency (EPA). Gorchov Negron et al. (2023) was able to take airborne air emission measurements for methane and compare them to OCS AQS at a basin and facility-level. A tiered-observing strategy using airborne measurements can be used for quantification of oil and gas emissions (McDonald et al. 2023).

Furthermore, this project would evaluate a hazardous air pollutant (USEPA 2024), formaldehyde, which is the highest emitted hazardous air pollutant reported in OCS AQS for BOEM's 2021 Emission Inventory. The BOEM's 2021 Emission Inventory indicates the highest offshore oil and gas source of formaldehyde emissions—not controlled by regulation—are from combustion flares (Thé C et al. 2023). The airborne air emission surveys will be able to analyze destruction and removal efficiencies (DRE) for flares. To-date, few field measurements have been taken of formaldehyde emissions from offshore oil and gas operations in the GOM (Duncan 2020).

Note this study overlaps with the study profile NT25, Verification of OCS AQS and Development of a Satellite-based Top-down Emissions Inversion System, and if costs are shared between the offices, each office's contribution would be lower. The study also overlaps with the study profile GM25 Air Quality Modeling in the Gulf of Mexico Region – 2025 Update for the optional task described in the methods.

Objective(s): This study will quantify basin to facility scale emissions (including methane, nitrogen oxides, total reactive nitrogen, formaldehyde, ethane, and CO) from oil and gas activities in the GOM.

Methods: This project would use in-kind contributions from NOAA. NOAA would operate and use their NOAA's P-3 and/or Twin Otter aircraft to collect measurements. The NOAA P-3 would perform about 38-hour sampling times over 14 days and the Twin Otter would perform about 7-hour sampling times per day for 7 days. Airborne surveys and satellite remote sensing data could occur near high-risk facilities using BSEE's risk-based inspection program. The quantified emissions would be compared to OCS AQS at a basin, facility, or source level, when possible. If the data indicates the air emissions reported in OCS AQS is underestimated or overestimated, then BSEE may follow-up with an inspection. Due to limited space on the Twin Otter aircraft, this project would be limited to a set of air pollutants (nitrogen dioxide, methane, carbon dioxide, ozone, and formaldehyde). The NOAA P-3 aircraft is larger and can hold more instruments than the Twin Otter therefore additional air pollutants can be measured like sulfur dioxide, volatile organic compounds, and ammonia.

An optional task would be to address uncertainties in the emission inventories and modeling system through these airborne measurements and/or satellite remote sensing data, when possible. This optional task would require collaboration with EPA through other BOEM studies like the Air Quality Modeling in the GOM region – 2025 Update. EPA would examine the modeling system using measurements made as part of these special field studies. NOAA would help and share knowledge with EPA.

Specific Research Question(s):

1. Based on field measurements, are any air emissions reported in OCS AQS being underestimated or overestimated? Can the facility and/or emissions source be identified?
2. What is the cause of the overestimation or underestimate of the air pollutants?

3. (Optional) How can emission inventories for sources in the Gulf of Mexico be evaluated and improved through airborne measurements and satellite products?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

[BSEE] Bureau of Safety and Environmental Enforcement. 2019. A new era of management: driving safety performance and environmental stewardship improvements beyond regulation through innovation and collaboration. Risk based inspections assessment report. New Orleans (LA): U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement. [accessed 2024 Jan 29]. https://www.bsee.gov/sites/bsee.gov/files/reports//bsee-rbi-2019.pdf

Duncan BN. 2020. NASA resources to monitor offshore and coastal air quality. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 41 p. Report No.: OCS Study BOEM 2020-046.

Gorchov Negron AM, Kort EA, Chen Y, Adames-Corraliza ÁF. 2023. Excess methane emissions from shallow water platforms elevate the carbon intensity of U.S Gulf of Mexico oil and gas production. PNAS. 120(15):e2215275120. Doi:10.1073/pnas.221527510.

McDonald B, He J, Harkins C, de Gouw J, Elguindi N, Duren R, Gilman J, Kort E, Miller C, Peischl J, et al. 2023. A review of U.S. oil and gas methane and air pollutant emissions. em: The Magazine for Environmental Managers. September 2023. 6 p. https://csl.noaa.gov/pubs/EM202309McDonald.pdf.

Thé C, Johnson M, Alkabbani H, Munshed M, Torrens A, Matthews B, Gomes A, Lim D, Thé J. 2023. Outer Continental Shelf Air Quality System (OCS AQS): year 2021 emissions inventory quality assurance/quality control (QA/QC) study. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 282 p. Report No.: OCS Study BOEM 2023-023.

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