

Gulf of Mexico Air Quality Study Concept: Trace Transport, Atmospheric Dynamics, Monitoring, and Modeling

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Notice

This proposed study concept has not been approved by BOEM's Environmental Studies Program, BOEM's Gulf of Mexico Regional Director, or BOEM's Scientific Advisory Committee.

*There is **NO** funding commitment for this proposed study concept at the present time.*



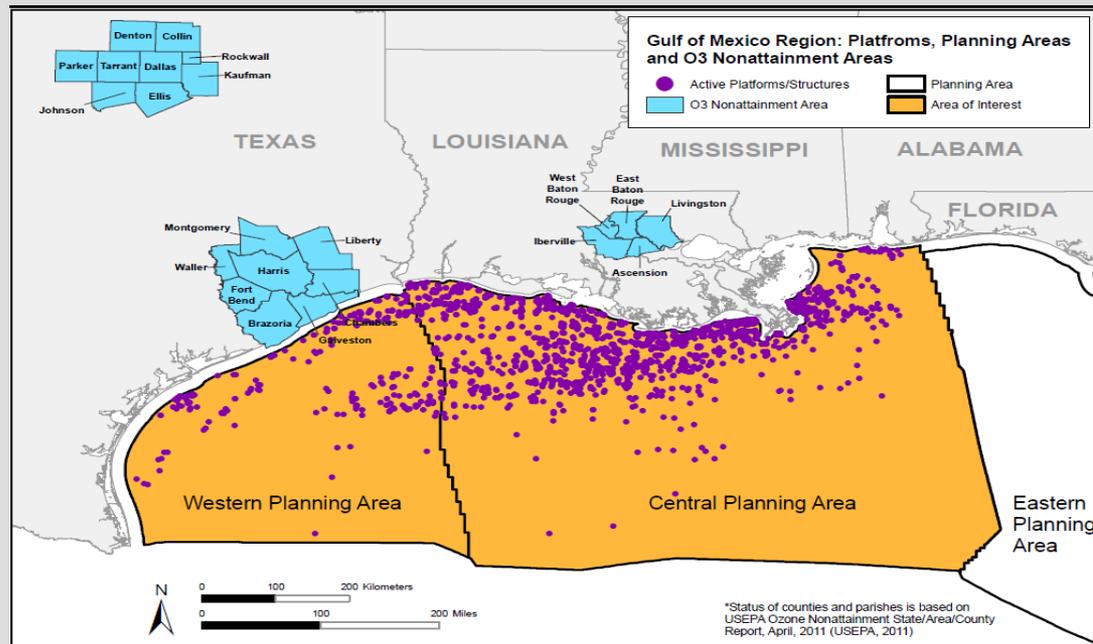
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Abstract

This study is used to gather atmospheric and surface measurements of criteria pollutants from offshore sources in the Gulf of Mexico's Western and Central Planning Areas.



The goal is to better understand the transport, transitions, and transformation of pollutants, particularly in coastal areas, and then enhance their prediction using long- and short-range models.



BOEM's 1993 to 2015 Studies: Air Quality, Emission Inventories (ESPIS)

STUDY TITLE	APPLICABLE PLANNING AREAS
Gulf of Mexico Air Quality Study (GMAQS) (MMS 95-0038, 95-0039, and 95-0040) (includes a comprehensive meteorological study)	Western and Central
Emission Inventories of OCS Production and Development Activities in the Gulf of Mexico (MMS 2002-073)	Western, Central, and Eastern
Gulfwide Emission Inventory for the Regional Haze and Ozone Modeling Effort (MMS 2004-072)	Central and Western
Data Quality Control and Emissions Inventories of OCS Oil and Gas Production Activities in the Breton Area of the Gulf of Mexico (MMS 2004-071)	GOM within 100 kilometers of the Breton Area
Year 2005 Gulfwide Emission Inventory Study (MMS 2007-067)	Central and Western
Year 2008 Gulfwide Emissions Inventory Study (BOEMRE 2010-045)	Central and Western
Year 2011 Gulfwide Emissions Inventory Study (BOEMRE 2014-666)	Central and Western
TOTAL: Approximately \$9 million	



BOEM 1993 to 2015 studies: Meteorology & Boundary Layer (*ESPIS*)

STUDY TITLE	APPLICABLE PLANNING AREAS
Effects of Offshore Emissions on Ambient Levels of Atmospheric SO ₂ at Breton Sound (MMS 95-0019)	Northeastern Gulf of Mexico
Long-term Measurements of SO ₂ and NO ₂ Concentrations and Related Meteorological Conditions in the Northeastern Gulf of Mexico (MMS 98-0020 and 2000-014)	Northeastern Gulf of Mexico
Observation of the Atmospheric Boundary Layer in the Western and Central Gulf of Mexico (MMS 2002-028)	Western and Central
Boundary Layer Study in the Western and Central Gulf of Mexico (MMS 2004-060)	Western and Central
Determining Overwater Visibility and Mixing Height Using Satellite and In-Situ (MMS 2005-008)	Northern Gulf of Mexico
Five-Year Meteorological Datasets for CALMET/CALPUFF and OCD5 Modeling of the Gulf of Mexico Region (MMS 2008-029)	Western, Central, and Eastern
SO ₂ and NO ₂ Increment Analysis for the Breton National Wilderness Area (MMS 2008-058)	Central
Synthesis, Analysis, and Integration of Meteorological and Air Quality Data for the Gulf of Mexico Region (MMS 2009-055, 2009-056, 2009-057, and 2009-058)	Western, Central, and Eastern
Satellite Data Assimilation into Meteorological/Air Quality Models (BOEMRE 2010-050 and 2010-051)	Central and Western
Meteorological and Wave Measurements for Improving Meteorological Modeling (BOEMRE 2013-01110)	Central
TOTAL: Approximately \$5 million	



Motivation

At present, there is not adequate over-water data information, and the modeling tools are incomplete to accurately predict offshore emission dispersions.

The numerical method that is recommended for use by oil and gas operators, i.e., the Offshore and Coastal Dispersion (OCD) model (Scire et al., 1995), is outdated.

Air quality is defined by Federal exposure standards; however, understanding its controlling processes requires knowledge of emissions, along with atmospheric physics and chemistry.

We need to evaluate and diagnose approved models, including the American Meteorological Society Environmental Protection Agency Regulatory Model (AERMOD) and longer range air quality models such as the Community Multi-scale Air Quality (CMAQ) and the Weather Research and Forecasting (WRF) model, which offer superior treatments for chemical transformations.



Scientific Questions

- *What is the spatial distribution of OCS oil and gas emission sources?*
- *How well do the approved and modern models perform in describing coastal concentrations?*
- *What are the main sources of particulate matter (PM) in the region? Is there a contribution from remote areas (Saharan dust)?*
- *What are the primary emission sources and how do they compare with BOEM's inventories?*
- *What is the fate of plumes from OCS sources in daily/hourly transitions?*
- *What is the effect of sea-breeze in pollutant transport and concentrations?*
- *What is the dynamic of nitrogen oxides (NO_x) and volatile organic compounds (VOC) in summer season, and what is their impact in ozone concentrations?*

These are complex issues that require interagency collaboration of modeling and field work experts.



Objective 1: Observational Data

- *The study involves field and station data from existing platforms/sensors during 3 consecutive years.*
- *The study will be designed to gather airborne measurements using aircrafts, ships, remote sensing (Light Detection and Ranging [LIDAR]), and surface data (meteorology and air quality stations) to monitor criteria pollutant.*

Long Term

- *3 consecutive years, hourly data.*
- *Simultaneous air quality and meteorology.*
- *Criteria pollutants, O_3 precursors.*
- *Stations: 6 onshore in LA; 2 coastal within 50 nmi offshore; and 1 oceanic within 50-75 nmi offshore.*

Short Term

- *2-week periods in summer: 2nd and 3rd years to collect high-resolution surface and vertical profiles of pollutants.*
- *Characterize the lower atmosphere (< 3 km) within ~100 nmi in the Western and Central Planning Areas. Study transport, transition, and chemical transformations.*
- *Assess regional main sources of PM. Evaluate the contribution over shoreline of PM sources from remote areas.*



Objective 2: Modeling

- *We need to integrate measurements with modeling systems to accurately assess the air quality in the region.*
- *We need to improve the prediction of concentrations. This scientific understanding is important in our regulatory process and strategies for mitigation. Shoreline and State waters are the areas of interest.*

Surface

- *Network of long-term stations at shoreline, coastal, and oceanic areas.*
- *Integrate surface satellite observations with stations and analyze time and spatial variability.*
- *Evaluate model performance.*

Atmospheric Profiles

- *LIDAR, on-board the research vessel, and/or aircraft instrumentation are alternatives to better understand the processes governing pollution levels.*
- *Evaluate model outputs of transport, transitions, and transformation.*
- *Skills of approved and modern models to predict concentrations.*



Interagency Partnerships

NOAA

Will perform short-term, high-resolution monitoring study in the Western and Central Planning Areas using aircraft and vessel.



BOEM

USEPA

RTP, Regions 4 and 10 are willing to provide guidance on modeling and data analysis.

American Petroleum Institute and Offshore Operators Committee

Finding volunteer operators to deploy air quality-meteorological stations at offshore oil and gas platforms.

Texas Commission on Environmental Quality

Willing to provide guidance on modeling and configuring air quality and meteorological stations, and data analysis.



Thanks

