Title	Wind Tunnel Experiments for Oil Platform Downwash
Administered by	Gulf of Mexico OCS Region
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Procurement Type(s)	Contract
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PICOC Summary	.
Problem	What are the effects of an oil platform structure on the characteristics of the air flow and a plume. Offshore oil platforms affect the characteristics of the air flow and plume and consequently the dispersion of pollutants. There is also a lack of data on algorithms to be used in air dispersion modeling.
Intervention	Carry wind tunnel experiments with an oil platform to identify the building wake effect on the plume behavior from an oil platform.
Comparison	The observations will be compared with those cases without the presence of an oil platform structure and also with available field observations.
Outcome	The air flow and the plume in the wake and downwind area should be measured and estimated. The new insights will be used to improve the dispersion algorithms used in air quality modeling studies.
Context	Air Quality regulations in the Gulf of Mexico Region.

BOEM Information Need(s): In order to improve overwater dispersion modeling, the Bureau of Ocean Energy Management (BOEM) needs to perform wind tunnel experiments to characterize oil platform downwash. This study will conduct the wind tunnel experiments to gather the downwash information which will be applied to improve the algorithms used in air quality modeling.

Air pollution dispersion models have been designed for onshore conditions. This study will investigate downwash in the offshore environment where air flows under raised buildings or through the lattice structure typical of offshore platform (Fox, 2017)

BOEM assesses the impacts of air emissions released from the OCS sources on the air quality of any State in the National Environmental Policy Act (NEPA) documents and through the review of oil and gas industry's post-lease exploration and development plans.

The Outer Continental Shelf Lands Act (OCSLA) requires compliance with the National Ambient Air Quality Standards (NAAQS) pursuant to the Clean Air Act (CAA). The CAA

also gives BOEM regulatory authority for air quality on the Outer Continental Shelf (OCS) in areas westward of 87°30'W longitude in the Gulf of Mexico. BOEM's regulations at 30 CFR 550 subpart B cite the USEPA modeling guidelines stating, "when BOEM requires air quality modeling, you (the lessee) must use the guidelines in [USEPA] appendix W of 40 CFR part 51 with a model approved by the Director". Hence, it is important that these overwater models realistically portray dispersion to adequately assess air quality impacts to improve overwater modeling. The oil platform downwash is a component of air dispersion modeling which will affect the predicted down-wind criteria pollutant concentrations.

Currently, because of technological advances and striving to improve offshore modeling algorithms, BOEM is considering replacing the USEPA's older Offshore and Coastal Dispersion Model Version 5 (OCD, 1989) air quality model, with the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee's Dispersion Model (AERMOD) for short-range air dispersion modeling.

Background: Over the past decade or more, BOEM and its predecessor agencies have engaged in an extensive research program on air quality. This program is being fueled by the need for better estimates of the impact of emissions resulting from offshore activity to air quality, the preparation of updated air quality regulations, and concerns collected during NEPA scoping meetings and public comments. Examples of our recent research include *Air Quality Modeling in the Gulf of Mexico Region* (GM 14-01), and *Testing and Evaluation of AERMOD Using AERCOARE and MMIF Meteorological Outputs Representative of the OCS* (NT-12-04). As a result of these investigations, future work is recommended to better understand platform downwash and the marine and coastal areas, which should improve the accuracy of the modeling and thus the OCS impacts. With more stringent National Ambient Air Quality Standards (NAAQS) in place, such as the 1-hour SO2 and NO2 standards with which facilities must comply, there has been an increased focus on the need to improve AERMOD's performance in modeling building downwash (Tyler Fox). Without the study of the building downwash and the updated algorithm, USEPA would not approve the AERMOD model for the offshore applications.

Objectives: This study is to conduct the wind tunnel experiments to obtain information on oil platform downwash to improve air quality modeling. A meteorological wind tunnel is often used to simulate the air flow and air dispersion in the atmospheric boundary layer.

The information obtained from the wind tunnel measurements is to understand the atmospheric process, characterizing the structure of the atmospheric boundary layer for air quality modeling and model validation. Specific objectives will include, but are not limited to:

- Conduct plume downwash experiments from a few oil platforms and in a meteorological wind tunnel, using structures that resemble oil and gas platforms;
- Conduct wind tunnel experiments for flow visualization;
- Collect data for dispersion modeling and model validation.

Methods: The approaches for this study are to conduct wind tunnel experiments. The wind tunnel experiments will be conducted under various atmospheric conditions. The specific methods include: (a) Perform meteorological wind tunnel experiments to understand downwash fluid dynamics of typical oil and gas platforms, length of influence and relevant dispersion parameters at small scale (order of 2 km), (b) Perform wind tunnel experiments for flow visualization, and (c) Deliverable: data collection, data archive, and final report

Specific Research Question(s):

The specific question is to understand the change of air flow and air concentration in the presence of the oil platform structure, and how to incorporate this information into the air dispersion model.

References:

Dispersion of Emissions from Offshore Oil Platforms – A Wind-Tunnel Modeling Evaluation. American Petroleum Institute. 1220 L Street, Northwest Washington, D.C., 20005. 1984.

Tyler Fox, Memorandum to EPA Regional Modeling Contacts: EPA White Papers on Planned Updates to AERMOD Modeling Systems, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. September 19, 2017.
https://www3.epa.gov/ttn/scram/models/aermod/20170919_AERMOD_Development_White_Papers.pdf

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