Title	Wind Tunnel Experiments for Offshore Oil and Gas Platform Downwash
Administered by	Gulf of Mexico OCS Region
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Procurement Type(s)	Contract
Approx. Cost	$250 (in thousands)
Performance Period	FY 2019–2021
Date Revised	January 3, 2018
PICOC Summary	
Problem	What are the effects of an oil or gas platform structure on the characteristics of the air flow and a plume? Offshore platforms affect the characteristics of the air flow and plume and consequently the dispersion of pollutants. There is also a lack of data on downwash algorithms to be used in air dispersion modeling for shallow water cases.
Intervention	Perform wind tunnel experiments with different types of oil or gas platform or drillship to identify the building wake effect on the plume behavior from that platform or drillship.
Comparison	The observations will be compared with those cases without the presence of an oil platform structure and 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 downwash algorithms used in air quality modeling studies.
Context	Central, Western, and Eastern Gulf of Mexico

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 offshore oil or gas platform or drillship 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 for impacts assessments.

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 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 U. S. Environmental Protection Agency (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, as required under regulations. The 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 impacts, 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. Air pollution dispersion models have been designed mostly for use in onshore environments for onshore conditions. The USEPA has suggested that platform downwash is one area that BOEM studies to improve AERMOD for offshore applications.

Background: Over the past decade or more, BOEM and its predecessor agencies have engaged in an extensive research program on air quality. Current program needs are derived from 3 main sources; better estimates of the impact of emissions resulting from offshore oil and gas 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 SO_2 and NO_2 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, USEPA). Without the study of the offshore building downwash and the updated algorithm, USEPA would not approve the AERMOD model for all cases for the offshore applications.

Objectives: This study is to conduct the wind tunnel experiments to obtain information on oil or gas platform or drillship 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 at a small scale from a few oil and gas platforms or drillship and in a meteorological wind tunnel, using structures that resemble oil and gas platforms or drillship. The field tracer experiments are also proposed;
- 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 or drillship, 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): How does the air flow and air concentrations change in the presence of oil or gas platform structure or drillship? Can BOEM improve the algorithms for platform downwash in AERMOD?

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