

**STUDY TITLE:** Year 2011 Gulfwide Emissions Inventory Study

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**CONTRACT NUMBER:** M10PC00084

**SPONSORING OCS REGION:** Gulf of Mexico

**APPLICABLE PLANNING AREAS:** Central and Western

**FISCAL YEARS OF PROJECT FUNDING:** 2010-2014

**COMPLETION DATE OF REPORT:** November 2014

**COSTS:** FY 2010: \$80,370; FY 2011: \$72,089; FY 2012: \$207,231; FY 2013: \$98,756; FY 2014: \$27,843. **CUMULATIVE PROJECT COST:** \$486,289

**PROJECT MANAGER** D. Wilson

**AFFILIATION:** Eastern Research Group, Inc.

**ADDRESS:** 1600 Perimeter Park Drive, Morrisville, North Carolina 27560

**PRINCIPAL INVESTIGATORS\*:** D. Wilson, R. Billings, R. Chang, H. Perez, and J. Sellers

**KEY WORDS:** Air pollutant emissions inventory, Gulf of Mexico, GOADS, marine vessels, criteria pollutants, greenhouse gases.

**BACKGROUND:** The Bureau of Ocean Energy Management (BOEM) is responsible for determining if air pollutant emissions from Outer Continental Shelf (OCS) oil and natural gas platforms and other sources in the Gulf of Mexico on the OCS influence the ozone attainment and nonattainment status of onshore areas. Consequently, the BOEM initiated a research study to develop a calendar year 2011 inventory of criteria air pollutant emissions and greenhouse gas emissions from offshore oil and gas exploration, development, and production in the Gulf of Mexico on the OCS. The inventory also includes non-OCS oil and gas production sources such as the Louisiana Offshore Oil Port (LOOP), military vessels, and commercial marine vessels.

**OBJECTIVES:** 1- Describe and quantify emission sources in the OCS that release criteria air pollutants (i.e., carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM), and volatile organic compounds (VOC)) and greenhouse gases (i.e., carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O)) over the course of one calendar year; 2- prepare a report that summarizes the emissions data, describes the methodology used to generate the emissions inventory; and 3- prepare

data files for platform and non-platform emissions sources that can be used in air quality modeling studies.

**DESCRIPTION:** The Year 2011 Gulfwide Emissions Inventory Study includes all oil and gas production platforms and non-platform sources in the Central and Western Gulf of Mexico on the OCS. Pollutants covered in the inventory are the criteria pollutants as well as greenhouse gases. The BOEM attempted to collect activity data from every major active offshore oil production platform in the Gulf of Mexico on the OCS. Operators were provided with the Gulfwide Offshore Activities Data System (GOADS) Visual Basic activity data collection software for compiling monthly data for calendar year 2011. A total of 2,544 oil and gas production platforms submitted monthly equipment activity data files. Rigorous quality assurance/quality control (QA/QC) activities were performed on the activity data collected from platform operators. The monthly activity data collected from the platform operators were then combined with emission factors and algorithms to develop the platform production equipment emission estimates. Inventory data files were compiled with the oil and gas production platform data suitable for use in air quality modeling applications. In addition to monthly emission estimates by pollutant and individual piece of equipment, the files include the company, structure, and complex ID, lease number, block and area number, and latitude/longitude. For each piece of equipment, stack parameter information, such as outlet height, exit velocity, and exit temperature, is also presented. Non-platform sources were also included in the inventory, such as pipelaying vessels, drilling vessels, and support helicopters and vessels. Calendar year 2011 activity data for non-platform sources were collected and combined with emission factors to develop emission estimates for non-platform sources in the Gulf of Mexico on the OCS. Non-platform emission estimates were allocated using location data provided by the BOEM, the National Marine Fisheries Service, and Automatic Identification Systems (AIS) datasets applied to Geographic Information System (GIS) shapefiles of lease blocks and areas. Inventory data files were compiled with the non-platform data, in a format suitable for use in air quality modeling applications.

**SIGNIFICANT CONCLUSIONS:** BOEM has undertaken the Year 2011 Gulf of Mexico Gulfwide Emissions Inventory Study to continue past assessments of the potential impacts of emissions from oil and gas exploration, development, and production in the OCS region of the Gulf of Mexico. The overall goal of the studies is to assess the effects that OCS development has on ozone concentrations in the onshore areas of Texas and Louisiana that are designated by the US Environmental Protection Agency (USEPA) as nonattainment for eight-hour average ozone. The Gulf of Mexico OCS area of possible influence also includes the states of Mississippi, Alabama, and Florida. Improvements continue to be made in the inventory development methods, such as the use of an improved data collection tool for monthly platform activity data, and the addition of diesel and dual-fuel turbines. Significant improvements also continue to be made for non-platform sources, particularly for emission estimates for marine diesel engines. Updated USEPA emission factors were used in this inventory that take into account vessel engine speed, fuel type, year of manufacture, and mode of operation.

**STUDY RESULTS:** The inventory results indicate that OCS oil and gas production platform and non-platform sources emit the majority of criteria pollutants and greenhouse gases in the Gulf of Mexico on the OCS. OCS platform and non-platform sources account for 90% of total CO emissions, 73% of NO<sub>x</sub> emissions, 68% of PM emissions, 63% of VOC emissions, and 85% of greenhouse gas emissions. Non-OCS sources emit the majority (58%) of SO<sub>2</sub> emissions. Oil and gas production platforms account for the majority of the CO and VOC emissions. Non-platform OCS oil and gas production sources such as support vessels and drilling vessels emit the majority of the estimated NO<sub>x</sub> and PM emissions. Non-OCS oil and gas production sources emit the majority of SO<sub>2</sub> emissions. For greenhouse gases, platform sources account for 57% of the emissions (in carbon dioxide equivalents, or CO<sub>2e</sub>). With the exception of VOC emissions, commercial marine vessels are the top-emitting non-OCS oil and gas production source in the inventory for both criteria pollutants and greenhouse gases. Vessel lightering and biogenic/geogenic sources account for the majority of VOC emissions from non-OCS oil and gas production sources.

Recommendations for future inventory efforts for platform sources in the Gulf of Mexico on the OCS focus on continuing to make use of the most recent emission factors and research results in developing the emission estimates for platform equipment. In addition, BOEM collects monthly volume vented and flared data from production operators via OGOR forms. 30 CFR Part 250, Oil and Gas and Sulphur Operations in the Outer Continental Shelf-Oil and Gas Production Requirements, now includes requirements that operators meter flared and vented gas volumes on facilities that process more than 2,000 barrels of oil per day, and to report flared gas separately from vented gas on the OGOR forms. Future inventory development efforts should again rely on the use of these reported data. Other recommendations for future inventory efforts for OCS oil and gas production platforms include validating or updating the surrogate gas analyses and fugitive component counts, given changes in offshore platform operations (e.g., deepwater platforms are more now common). In addition, an evaluation of the surrogate fuel usage rates used to estimate emissions for pneumatic pumps and pressure level controllers is needed.

For non-platform sources, the main recommendation for future inventory efforts is to develop a technique that better uses the AIS vessel tracking data to time-stamp when vessels enter and leave federal waters of the Central and Western areas of the GOM to accurately estimate hours of operation in the region. This will provide more accurate estimates of activity and emissions. Additional research is also needed to confirm the reasonableness of the variance noted in the monthly drilling rig, pipelaying, support vessels, and commercial fishing temporal adjustment factors. Future non-platform inventory efforts should also evaluate how new pipelaying construction activities differ from maintenance operations with regard to required vessel support and hours of operation.

Last, it would be beneficial to perform a top-down assessment of the 2011 emission estimates, similar to assessments that are performed with on-shore emissions inventories. In addition, at the completion of the 2014 inventory development effort,

BOEM will have emission estimates for six consecutive inventory studies that span 2000-2014. Detailed and comprehensive expanded comparisons and deviations (trends analyses) will benefit BOEM in a number of ways, including predicting future emission trends in spatial terms.

**STUDY PRODUCTS:** Wilson, D., R. Billings, R. Chang, H. Perez, and J. Sellers. 2014. Year 2011 Gulfwide emissions inventory study. US Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2014-XXX.

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\*P.I.'s affiliation may be different than that listed for Project Managers.