

STUDY TITLE: Year 2014 Gulfwide Emissions Inventory Study

REPORT TITLE: Year 2014 Gulfwide Emissions Inventory Study

CONTRACT NUMBER: M13PC00005

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREAS: Central and Western

FISCAL YEARS OF PROJECT FUNDING: 2013-2017

COMPLETION DATE OF REPORT: March 2017

COSTS: FY 2013: \$61,100; FY 2014: \$53,300; FY 2015: \$196,438; FY 2016: \$298,738; FY 2017: \$79,172. **CUMULATIVE PROJECT COST:** \$688,748

PROJECT MANAGER: D. Wilson

AFFILIATION: Eastern Research Group, Inc.

ADDRESS: 1600 Perimeter Park Drive, Suite 200, Morrisville, North Carolina 27560

PRINCIPAL INVESTIGATORS: D. Wilson, R. Billings, R. Chang, S. Enoch, B. Do, H. Perez, and J. Sellers

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

BACKGROUND: The Bureau of Ocean Energy Management (BOEM) is responsible for assessing the potential impacts of air pollutant emissions from offshore oil and gas exploration, development, and production sources on the Outer Continental Shelf (OCS). BOEM conducted limited emission inventories in the Gulf of Mexico (GOM) OCS in the 1980s. BOEM then completed emission inventory studies in 1995, 2004, 2007, 2010, and 2014 (i.e., for calendar years 2000, 2005, 2008, and 2011). Because the offshore sources are changing due to new technology and drilling in deep waters and because of new and updated National Ambient Air Quality Standard (NAAQS) standards, BOEM continues to update the emissions inventories every three years.

OBJECTIVES: 1) Describe and quantify emission sources in the OCS that release criteria air pollutants, criteria pollutant precursors, and major greenhouse gases (GHGs) over the course of one calendar year; 2) conduct an initial scoping task to assess production platform hazardous air pollutant emissions; 3) conduct detailed and comprehensive emissions trends analyses of BOEM inventories spanning 2000 to 2014 to assess the long-term emission trends in GOM OCS emissions; 4) prepare a report that describes the methodology used to generate the emissions inventory and summarizes the emission estimates; and 5) prepare data files for platform and non-platform emission sources that can be used in air quality modeling studies.

DESCRIPTION: The Year 2014 Gulfwide Emissions Inventory Study includes all oil and gas production platforms and non-platform sources in the Eastern, Central, and Western Planning Areas of the GOM west of 87.5 degrees longitude. Pollutants covered in the inventory are the criteria air pollutants—carbon monoxide (CO), lead (Pb), nitrogen oxides (NO_x), sulfur dioxide (SO₂), particulate matter-10

(PM₁₀), particulate matter-2.5 (PM_{2.5}), PM precursor ammonia (NH₃), ozone precursor volatile organic compounds, and major GHGs—carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). This is the first inventory cycle to include Pb and NH₃. BOEM collected activity data from active offshore oil production platforms in the GOM OCS via the Gulfwide Offshore Activities Data System (GOADS) Microsoft® Visual Basic® activity data collection software. Rigorous quality assurance/quality control activities were performed on the activity data collected from platform operators. The data were then combined with emission factors and emission estimation algorithms to develop the platform production equipment emission estimates. Non-platform sources included in the inventory were pipelaying vessels, drilling rigs, support vessels, and helicopters that support oil and gas development, and other sources, such as the Louisiana Offshore Oil Port, military vessels, commercial marine vessels, and geogenic sources. Emission estimates for most marine vessels were developed based on automatic identification system (AIS) data in conjunction with classification society vessel characteristics, which provides more accurate estimates of the vessels operating in the GOM, their power ratings, and propulsion engine load estimates.

SIGNIFICANT CONCLUSIONS: Comparisons of pollutant-specific emission estimates for oil and natural gas production platform and non-platform oil and gas production-related sources between 2011 and 2014 show a decrease in all emission estimates for 2014. The emission estimates for some of the sources that are not associated with oil and gas production increased, particularly commercial marine vessels. This is due to a more complete assessment of the vessels transiting the GOM, specifically the inclusion of cruise ships and dredging vessels. The results of the emission trends analyses conducted for the 2000 through 2014 emissions inventories indicate that overall, emissions are largely affected by three factors: activity and production levels, changes in inventory methodologies, and improvements in available emission factors. There was qualitative agreement found to the spatial distribution of total production; however, there are factors that mask this trend at a total inventory level, including emission estimation methods and the increase in deepwater production. For example, with the increased use of AIS data to track marine vessel movements and more detailed vessel attribute data, the non-platform emissions inventories have changed the most over the inventory years, especially the BOEM sources. In addition, the total production trend to the emission estimates does not hold true for 2014, as higher production was paired with decreased emissions and number of platforms.

STUDY RESULTS: The 2014 emission estimates for oil and natural gas production platform and non-platform oil and gas production-related sources show a decrease in all emission estimates between 2011 and 2014. The most significant decreases are in the SO₂ (73% decrease), PM (68% decrease), and NO_x (60% decrease) emission estimates. CH₄ emissions decreased less considerably—17% from 2011 to 2014. For oil and natural gas production platforms, all emission estimates show substantial decreases, the most notable being an 84% decrease in SO₂ emissions. This reduction is driven for the most part by a reduction in the natural gas, diesel, and dual fuel turbine emission estimates. NO_x emissions decreased by 42%, with all combustion source emission estimates decreasing. A comparison of the 2011 and 2014 emission estimates for non-platform sources also indicates a significant decrease in emission estimates for OCS oil and gas production-related vessels. This is due at least in part to the use of AIS data, which provides more accurate estimates of the vessels operating in the GOM, their power ratings, and propulsion engine load estimates. Most significant is the NO_x emission estimate (67% decrease), driven predominantly by support vessels, and the SO₂ and PM emission estimates (71% and 73% decrease, respectively), driven by drilling rigs. There were, however, increases in SO₂ emissions for pipelaying and survey vessels accounting for the use of larger vessels. The emission estimates for some of the sources not associated with oil and gas production increased, particularly commercial marine vessels. This is due to a more complete assessment of the vessels transiting the GOM, specifically the inclusion of cruise ships and dredging vessels.

Recommendations for future inventory efforts for platform sources in the GOM 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, validate or update the surrogate gas analyses and fugitive component counts, and evaluate the surrogate fuel usage rates used to estimate emissions for pneumatic devices. For non-platform sources, the main recommendation for future inventory efforts is to continue to use AIS vessel tracking data to accurately estimate vessel emissions. This has been proven to provide more accurate estimates of activity and emissions. There is also an alternative approach to estimating helicopter activities and emissions using the Federal Aviation Administration's NextGen tracking data. Last, the recommendations of the detailed emission trends analysis conducted are that changes and improvements made to the estimation methods be closely tracked, with discussion of potential impacts to trends. This will ensure that future analyses, especially long-term trends analyses, take these factors into consideration when drawing conclusions on overall trends. Furthermore, a full trends analysis should be revisited periodically to incorporate new analysis techniques that better discern true trends in emissions data.

STUDY PRODUCTS: Wilson, D., R. Billings, R. Chang, S. Enoch, B. Do, H. Perez, and J. Sellers. 2017. Year 2014 Gulfwide emissions inventory study. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2017-044.

Wilson D. and B. Boyer. 2014. User's Guide for the 2014 Gulfwide Offshore Activities Data System (GOADS-2014). U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2014-606.