

# Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2013: Revision to Offshore Platform Emissions Estimate

## Revision Implemented in Public Review Draft

### **Overview of Method in 2014 Inventory (estimates for 1990-2012)**

The U.S. Department of the Interior (DOI) began inventorying offshore platform greenhouse gas emissions in the Bureau of Ocean Energy Management's (BOEM) Gulf Offshore Activity Data System (GOADS) for 2000 with additional inventories for 2005, 2008 and 2011. GOADS collects monthly activity data from platform sources; these activity data are combined with the most recent emission factors (EFs) published by the EPA, and Emission Inventory Improvement Program (EIIP) emission estimation methods to develop a greenhouse gas emissions inventory. The original year 2000 GOADS data was used to develop the EFs used in EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012* released in 2014 (2014 Inventory) for offshore platform emissions.

### **Revised Approach for 2015 Inventory**

EPA solicited feedback from expert reviewers<sup>1</sup> on several options for developing and applying revised EFs for offshore oil and gas emissions in the GHG Inventory. Expert reviewers agreed that more recent years of GOADS data (2005, 2008, and 2011) can be used to improve the accuracy of EFs used across the time series. Expert reviewers supported an approach wherein EFs would be developed for each year of available GOADS data, and used for the Inventory years on either side of the GOADS inventory year that provides the EF. Expert reviewers pointed out that flaring and venting limitations for offshore facilities under 30 CFR 250 Subpart K became effective in 2010, so using the 2011 emissions data for prior years may not be an accurate representation.

Taking into account this expert review feedback, EPA plans to implement an approach where new sets of EFs will be developed from each year of GOADS inventory data and used for the national inventory years on either side of the GOADS inventory year that provides the EF.

In order to calculate EFs for a given year of GOADS data, the platform data in GOADS are separated into the four categories used in the GHG Inventory: deepwater gas; deepwater oil; shallow water gas; and shallow water oil. Then, the reported emissions for each platform group are used to develop average platform EFs (scf pollutant/day/platform). More details on the methodology used to develop the EFs are presented in Appendix A. Note that the revised EFs discussed in this memorandum exclude carbon dioxide (CO<sub>2</sub>) emissions from flaring on offshore platforms, which is a separate line item in the natural gas systems Inventory; a request for stakeholder feedback on potentially revising CO<sub>2</sub> flaring emissions is included at the end of this memorandum. The EFs resulting from year 2011 GOADS data are presented below in Table 1. EPA is in the process of calculating EFs for GOADS years 2005 and 2008. Therefore, this methodology revision has only been partially implemented in the 2015 Inventory public review draft—year 2011 EFs have been used across all years of the time series.

EPA also sought expert review feedback on two options assessed for distinguishing between oil and gas wells (both onshore and offshore). Based on expert review feedback, EPA used a gas-to-oil ratio (GOR) threshold of 100 mcf/bbl to distinguish onshore gas wells from onshore oil wells; GOR greater than 100 mcf/bbl indicates a gas well, and less than or equal to 100 mcf/bbl indicates an oil well. A GOR threshold of 100 mcf/bbl is employed by states including Texas, Alaska, and Pennsylvania to define onshore gas wells versus oil wells. EPA used this same GOR threshold to delineate oil versus gas platforms in the GOADS data.

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<sup>1</sup> Every year, the Inventory undergoes an expert review period during which a first draft of the document is sent to a select list of technical experts outside of EPA. The purpose of the Expert Review is to encourage feedback on the methodological and data sources used in the current Inventory, especially for sources which have experienced any changes since the previous Inventory. This memorandum references feedback from 2015 Inventory expert reviewers.

Table 1 presents the EFs for methane (CH<sub>4</sub>) and CO<sub>2</sub> that were developed from 2011 GOADS. The EFs resulting from the GOADS 2011 inventory are presented in the third column and the EFs used in the 2014 Inventory are presented in the fourth column of Table 1 below. As seen in Table 1, when gas platforms are defined as producing more than 100 mcf/bbl, there are no deepwater gas platforms in the available database, resulting in no EF for this platform group. EPA's estimates in the 2015 Inventory public review draft assign the deepwater oil platform EF to deepwater gas platforms as a surrogate.

**Table 1. Update Implemented in Public Review Draft — EFs Based on GOADS 2011**

Depth	Well Type	2011 GOADS Platform EF (scf/day)	2014 Inventory Platform EF (scf/day)
<b>CH<sub>4</sub> EFs</b>			
DEEP >656ft	GAS	--	79,452
DEEP >656ft	OIL	93,836	260,274
SHALLOW	GAS	8,899	19,178
SHALLOW	OIL	16,552	54,795
<b>CO<sub>2</sub> EFs</b>			
DEEP >656ft	GAS	--	403
DEEP >656ft	OIL	1,100	1,701
SHALLOW	GAS	166	97
SHALLOW	OIL	276	358

The impacts of changing the current Inventory EFs to those developed from the GOADS 2011 data are presented in Table 2 below, for year 2012. Note, global warming potential of CH<sub>4</sub> is assigned as 25 in Table 2.

**Table 2. Impact of New Factors from GOADS on Year 2012 National Estimates**

	2014 Inventory	Inventory with GOADS Year 2011 EFs
<b>Gas Platforms (MT of specified gas):</b>		
CH <sub>4</sub> : Shallow Water Platforms	266,000	123,000
CH <sub>4</sub> : Deep Water Platforms	23,000	27,000
CO <sub>2</sub> : Shallow Water Platforms	1,300	2,300
CO <sub>2</sub> : Deep Water Platforms	116	320
CO <sub>2</sub> : Flaring	358,000	358,000
<b>Total GHG (MTCO<sub>2</sub>e)</b>	<b>7,584,000</b>	<b>4,100,000</b>
<b>Oil Platforms (MT of specified gas):</b>		
CH <sub>4</sub> : Shallow Water Platforms	553,000	168,000
CH <sub>4</sub> : Deep Water Platforms	54,000	19,000
CO <sub>2</sub> : Shallow Water Platforms	10,000	8,000
CO <sub>2</sub> : Deep Water Platforms	1,000	620
<b>Total GHG (MTCO<sub>2</sub>e)</b>	<b>15,186,000</b>	<b>4,700,000</b>

#### **Comparison of 2014 Inventory, Inventory Revision, and GHGRP data**

In the 2014 Inventory for natural gas and petroleum systems source categories, 2012 emissions from offshore oil and gas platforms were 0.90 MMT CH<sub>4</sub> and 0.37 MMT CO<sub>2</sub>. For year 2012, the GHGRP received reports from 106 oil and gas platforms with emissions totaling 0.06 MMT CH<sub>4</sub> and 0.47 MMT CO<sub>2</sub> from sources analogous to those included in natural gas and petroleum systems. The revision to the Inventory decreases 2012 emissions in the GHG Inventory to 0.34 MMT CH<sub>4</sub> and 0.37 MMT CO<sub>2</sub>. The difference between GHGRP and the Inventory CH<sub>4</sub> emissions is attributable to the GHGRP only covering facilities that have combined GHG emissions equal to or exceeding 25,000 MTCO<sub>2</sub>e in all offshore waters. The difference between GHGRP and Inventory CO<sub>2</sub> emissions is attributable to differences in the "flaring" emissions source which accounts for nearly 98% of CO<sub>2</sub> emissions. The current methodology for offshore platform flaring emissions

has not been revised, and is based on annual volumes of vented and flared gas in conjunction with an estimated proportion of gas that is flared. These annual data have historically been obtained directly from MMS/BOEMRE, but have not been updated since 2008 due to lack of available data. A request for stakeholder feedback on the methodology for this emissions source is included below.

### **Request for Stakeholder Feedback**

- Based on expert review feedback, EPA is in the process of implementing an approach wherein new sets of EFs will be developed from each year of GOADS inventory data and used for the national inventory years on either side of the GOADS inventory year that provides the EF.
  - EPA seeks feedback on potentially excluding year 2000 GOADS from this approach, due to data quality issues noted by GOADS.<sup>2</sup>
  - EPA seeks feedback on applying EFs developed from years 2005, 2008, and 2011 GOADS data by the following methodology to develop 2015 Inventory emissions estimates:
    - EFs from GOADS year 2005 are applied to Inventory years 1990 through 2006;
    - EFs from GOADS year 2008 are applied to Inventory years 2007 through 2009; and
    - EFs from GOADS year 2011 are applied to Inventory years 2010 through 2013.
- EPA seeks feedback on available platform activity data that may be used to improve the current Inventory methodology. Currently, platform counts in each of the four categories are based on a nationwide DOI platform census that has not been updated since 2010. The current data source does not differentiate between active and inactive platforms; therefore, current methodology applies an EF for active platforms to a total platform count, which may result in overestimated sector emissions. An activity data source is sought that includes the following data elements for oil and gas offshore platforms: coverage of years 1990 through 2013; indication of active/inactive status in each year; indication of relative production of gas and oil in each year; and indication of platform depth.
- In addition to CH<sub>4</sub> and CO<sub>2</sub> EFs for each platform category that are developed from GOADS data, the current Inventory includes a separate line item for flaring CO<sub>2</sub> emissions from offshore natural gas platforms. The flaring CO<sub>2</sub> emissions are currently based on annual volumes of vented and flared gas in conjunction with an estimated proportion of gas that is flared, obtained directly from MMS/BOEMRE. These data inputs have not been updated in recent years due to lack of available data. EPA seeks feedback on a data source that would provide volumes of flared gas from offshore platforms on an annual basis covering 1990 through 2014.

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<sup>2</sup> References: *2000 Gulfwide Emission Inventory Study for Regional Haze and Ozone Modeling Effort*, and *Year 2011 Gulfwide Emission Inventory Study*

## Appendix A: Methodology for Developing GOADS 2011 Factors

The following general steps were taken to develop platform-based EFs:

- The 2011 Gulfwide Inventory for platform sources was used to obtain CH<sub>4</sub> and CO<sub>2</sub> emissions by platform, and included the lease ID, complex ID, and structure ID in the data set.
- The above data set was linked to BOEM's Platform Masters table downloaded from this website: [https://www.data.boem.gov/homepg/data\\_center/platform/platform.asp](https://www.data.boem.gov/homepg/data_center/platform/platform.asp) to provide the water depth for each platform.
- Platforms with water depth greater than 656 feet were flagged as deep water platforms. Platforms with water depth less than 656 feet were flagged as shallow water platforms. This depth is the same depth used to divide platforms for the current Inventory method.
- Only one lease had platforms that were identified as both deep water and shallow water. There were no emissions associated with the deep water platform with this lease; therefore, it was assigned to shallow water for this analysis.
- The Gulfwide Inventory lease IDs were linked to the 2011 BOEM Oil and Gas Operations Reports (OGOR) production data downloaded from this website for use in categorizing the platforms as "gas" or "oil": [https://www.data.boem.gov/homepg/pubinfo/freeasci/product/freeprod\\_ogora.asp](https://www.data.boem.gov/homepg/pubinfo/freeasci/product/freeprod_ogora.asp). Matches were found in the OGOR production data set for 995 out of 1176 leases. Of the unmatched lease IDs from the Gulfwide Inventory, only 47 (4%) had CH<sub>4</sub> emissions and production values reported for GOADS.
- Using the OGOR production data for oil and gas, each lease was categorized as "oil" or "gas" by defining gas leases as those that have a production ratio of 100 mcf gas per barrel of oil produced or greater.
- Methane emissions were averaged over all platforms in a category to develop an average platform methane EF.
- For developing CO<sub>2</sub> EFs, emissions from boilers, engines, drilling rigs, flares, and turbines were excluded. The resulting CO<sub>2</sub> EFs included emissions from flashing, mud degassing, pneumatic pumps, pressure level controllers, and cold vents. The 2011 GOADS data does not include CO<sub>2</sub> emissions for amine units, fugitives, glycol dehydrators, or storage tanks.
- Annual GOADS data was divided by 365 to develop daily EFs.