December 2014

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

Update Under Consideration for 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. There have been improvements in GOADS data collection and processing since 2000. There is more comprehensive participation by the platforms, and the rate of reporting errors has dropped. Over 20% of the reports in 2000 contained data errors, while less than 1% of the reports in 2011 contained data errors.[1]

Revision Under Consideration for Public Review Draft

The 2011 GOADS data (verified and released in 2014) can be used to revise the EFs used to calculate offshore oil and gas emissions in the GHG Inventory. The platform data in GOADS were separated into the four categories used in the GHG Inventory methodology: oil versus gas platforms and deep water versus shallow water platforms. Then, the reported emissions for each platform group were used to develop average platform EFs. The resulting factors are presented below. This revision has not been implemented in the Expert Review draft but is planned for the Public Review draft.

Updated activity data was also sought for oil and gas offshore platforms, as the current Inventory activity data is based on a nationwide DOI platform census that has not been updated since 2010. As a result, new references were identified that provide current year platform counts, which will be used in 2015 and future inventories:

- Gulf Offshore Statistics by Water Depth. Available online at: https://www.data.boem.gov/homepg/data_center/production/production.asp
- Pacific Region Facts and Figures. Available online at: http://www.boem.gov/BOEM-Newsroom/Offshore-Stats-and-Facts/Pacific-Facts-and-Figures.aspx

Table 1 presents the EFs for methane (CH_4) and carbon dioxide (CO_2) that were developed from the 2011 GOADS. For developing the GOADS factors, offshore platforms were divided into deep and shallow water platforms, with deep water having a depth of 656 feet or greater. This depth is the same depth used to divide platforms for the current Inventory method. Since the definition of gas platform for the current Inventory is not available, two definitions for gas platforms were investigated: platforms producing more than 12.5 thousand cubic feet (mcf) per barrel (bbl) and platforms producing more than 100 mcf/bbl. 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. More details on the methodology used to develop these factors are presented in Appendix A. As seen in Table 1, when gas platforms are defined as producing more than 100 mcf/bbl, there are no deep water gas platforms in the available database, resulting in no EF for this platform group. The factors used to estimate flaring CO_2 emissions are presented in the last section of Table 1. The flaring CO_2 emissions that are calculated with these factors are presented as a single line item in the natural gas systems inventory for all platforms, regardless of water depth or type of formation (i.e., oil or gas).

[1] References: *2000 Gulfwide Emission Inventory Study for Regional Haze and Ozone Modeling Effort*, and *Year 2011 Gulfwide Emission Inventory Study*

Table 1. Update Under Consideration--EFs Based on GOADS 2011

Depth	Well Type	Updated GOADS Platform EF (scf/day)	2014 Inventory Platform EF (scf/day)
CH_4 EFs by Gas Well Definition 1: >12.5mcf/bbl			
DEEP >656ft	GAS	81,479	79,452
DEEP >656ft	OIL	95,123	260,274
SHALLOW	GAS	10,508	19,178
SHALLOW	OIL	17,626	54,795
CH_4 EFs by Gas Well Definition 2: >100mcf/bbl			
DEEP >656ft	GAS	--	79,452
DEEP >656ft	OIL	93,836	260,274
SHALLOW	GAS	8,899	19,178
SHALLOW	OIL	16,552	54,795
CO_2 EFs by Gas Well Definition 1: >12.5mcf/bbl			
DEEP >656ft	GAS	156	403
DEEP >656ft	OIL	1,198	1,701
SHALLOW	GAS	195	97
SHALLOW	OIL	287	358
CO_2 EFs by Gas Well Definition 2: >100mcf/bbl			
DEEP >656ft	GAS	--	403
DEEP >656ft	OIL	1,100	1,701
SHALLOW	GAS	166	97
SHALLOW	OIL	276	358
Data used for Calculating CO_2 from Flaring on all Platforms			
Total Gulf vented and flared (MMcf)		12,602	11,746
Estimated fraction of vented gas flared		0.43	0.51

The impacts of changing the Inventory EFs to those developed from the GOADS 2011 inventory are presented in Table 2.

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

	2014 Inventory	Inventory with GOADS EF (gas well def. 1)	Inventory with GOADS EF (gas well def. 2)
Gas Platforms (MT of specified gas):			
Methane: Shallow Water Platforms	266,000	146,000	123,000
Methane: Deep Water Platforms	23,000	24,000	0
CO_2: Shallow Water Platforms	1,300	2,700	2,300
CO_2: Deep Water Platforms	116	45	0
CO_2: Flaring (all platforms, includes oil and gas)	358,000	324,000	324,000
Total GHG ($MTCO_2e$)[a]	**7,584,000**	**4,600,000**	**3,400,000**
Oil Platforms (MT of specified gas):			
Methane: Shallow Water Platforms	553,000	178,000	167,000
Methane: Deep Water Platforms	54,000	19,000	19,000
CO_2: Shallow Water Platforms	10,000	8,000	7,600
CO_2: Deep Water Platforms	1,000	680	630
Total GHG ($MTCO_2e$)[a]	**15,186,000**	**4,900,000**	**4,700,000**

a – Global warming potential of CH_4 is assigned as 25.

Comparison of 2014 Inventory and Inventory Revision with 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_4 and 0.37 MMT CO_2. For year 2012, the GHGRP received reports from 106 oil and gas platforms with emissions totaling 0.06 MMT CH_4 and 0.47 MMT CO_2 from sources analogous to those included in natural gas and petroleum systems. The proposed revision would decrease emissions in the GHG Inventory to 0.37 MMT CH_4 and 0.34 MMT CO_2, based on gas well definition 1 described above. The difference between GHGRP and the Inventory is attributable to the GHGRP only covering facilities that have combined GHG emissions equal to or exceeding 25,000 $MTCO_2e$ in all offshore waters.

Request for Stakeholder Feedback

- There are several options for applying the revised emission factors. EPA seeks stakeholder feedback on these options.
    - Apply the new factors developed from GOADS 2011 for the full time series of 1990 through 2013. The 2014 Inventory applies a single emission factor over all years, using the 2000 GOADS data, which was the first year of the GOADS inventory.
    - The GOADS inventories were conducted for the years 2000, 2005, 2008 and 2011. EFs have now been developed for the 2000 and 2011 GOADS inventories. The factors from the 2000 GOADS inventory could be used from 1990 up through an in-between year such as 2005; and the factors from the 2011 GOADS inventory could be used from 2005 through subsequent years of the national inventory.
    - Four new sets of EFs could be developed from the four GOADS inventories and used for the national inventory years on either side of the GOADS inventory year that provides the EF.
- EPA seeks feedback on the two options assessed for distinguishing between oil and gas wells. For additional information, please see memorandum *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2013: Proposed Revision to Data Source for Well Counts*. EPA also seeks feedback on the use of the two new references presented above for active offshore platform counts.

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_4 and CO_2 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 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.
- 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. 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_4 emissions and production values reported for GOADS.
- Using the OGOR production data for oil and gas, each lease was categorized as "oil" or "gas" using two definitions:
    - Definition 1 – Gas leases have a production ratio of 12.5 mcf gas per barrel of oil produced or greater.
    - Definition 2 – Gas leases 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_2 EFs, emissions from boilers, engines, drilling rigs, flares, and turbines were excluded. The resulting CO_2 EFs included emissions from flashing, mud degassing, pneumatic pumps, pressure level controllers, and cold vents. The 2011 GOADS data does not include CO_2 emissions for amine units, fugitives, glycol dehydrators, or storage tanks.
- Annual GOADS data was divided by 365 to develop daily EFs.