

Library of Places to Find Emissions Factors for the Oil and Gas Sector

Compiled for the California Air Resources Board by Angela Zahniser

AGO

Australian Greenhouse Office: This document includes vented emission factors for gas processing plants and emission factors related to flaring, but does not present emission factors for transmission or storage. The AGO presents one emission factor that captures vented, fugitive and combustion GHGs from all oil and gas industry sectors in a single “full fuel cycle” emission factor.

API Compendium

GRI/EPA study data are used, and emission factors are presented with different units than factors using the same data in GHGCalc. As discussed further below, the API Compendium is primarily throughput based, while the GHGCalcTM approach is primarily equipment based. Both approaches primarily use the GRI/EPA data and thus have similar uncertainty in the emission factors.

http://www.api.org/ehs/climate/new/upload/2004_COMPENDIUM.pdf

4.0 COMBUSTION EMISSION ESTIMATION METHODS

Table 4-1. CO2 Combustion Emission Factors (Fuel Basis) for Common Industry Fuel Types

Table 4-2. CO2 Combustion Emission Factors (Fuel Basis) for Specialized Fuel Types

Table 4-3. Fraction of Carbon Oxidized for Fuel basis CO2 Combustion Emission Factors

Table 4-4a. Equipment Specific Combustion Emission Factors for Boilers and Furnaces (Non-Solid Fuels)

Table 4-4b. Equipment Specific Combustion Emission Factors for Boilers and Furnaces (Solid Fuels)

Table 4-5. Engines and Turbines Emission Factors

Table 4-6. “Generic” Upstream Gas Composition

Table 4-7. GHG Emission Factors for Gas Flares

Table 4-8. GHG Emission Factors for Liquid Flares

Table 4-9. Mobile Source Combustion Emission Factors

Table 4-10. Default Fuel Economy Factors for Different Types of Mobile Sources

Table 4-12. Electricity Usage Emission Factors by Method of Generation

Table 4-15. Summary of Cogeneration Emissions – WRI/WBCSD Efficiency Allocation Approach

Table 4-16. Summary of Cogeneration Emissions – California Climate Action Registry Efficiency Allocation Approach

Table 4-17. Summary of Cogeneration Emissions – Work Potential Allocation Approach

Figure 4-1. Calculating CO2 Emissions from Stationary Combustion Sources

Figure 4-2. Calculation Approaches for Gas Flare

Figure 4-3. Calculation Approaches for Liquid Flare Emissions

Figure 4-4. Calculation Approaches for Mobile Source CO2 Emissions

Figure 4-5. Decision Tree for Purchased Electricity Emissions

Examples in Chapter 7

California Climate Action Registry

<http://www.climateregistry.org>

Canadian Association of Petroleum Producers (CAPP)

Canada Petroleum Industry: A National Inventory of Greenhouse Gas (GHG), Criteria Air Contaminant (CAC) and Hydrogen Sulphide (H₂S) Emissions by the Upstream Oil and Gas Industry: Volume 4 Methodology for CAC and H₂S Emissions
<http://www.capp.ca/raw.asp?x=1&dt=NTV&e=PDF&dn=86224>

EIA

Fuel and Energy Source Codes and Emission Coefficients

<http://www.eia.doe.gov/oiaf/1605/factors.html>

EPA, AP-42

<http://www.epa.gov/ttn/chief/ap42/index.html>

<http://epa.gov/climatechange/emissions/usinventoryreport07.html>

EPA Office of Compliance Sector Notebook Project: Profile of the Oil and Gas Extraction Industry

[Entire Document \(PDF\)](#) (165 pp, 811K)

- [First Section \(PDF\)](#) (51 pp, 793K)
 - Chapter I - Introduction to the Sector Notebook Project
 - Chapter II - Introduction to the Industry
 - Chapter III - Industrial Process Description
- [Second Section \(PDF\)](#) (63 pp, 581K)
 - Chapter IV - Chemical Release and Transfer Profile
 - Chapter V - Pollution Prevention Opportunities
 - Chapter VI - Summary of Federal Statutes and Regulations
- [Third Section \(PDF\)](#) (41 pp, 444K)
 - Chapter VII - Compliance and Enforcement History
 - Chapter VIII - Compliance Assurance Activities and Initiatives
 - Chapter IX - Contacts/Resource Materials

<http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/oil.html>

GRI / EPA Study

The data from this report continue to be used for emission factors for vented emissions from gas transmission and storage.

GRI-GHGCalcTM software

The emission factors for all tiers are from the GRI/EPA study, with some supplementary data. Version 1.2 of the software includes different factors for U.S. and Canadian operations.

IPCC

http://www.ipcc-nggip.iges.or.jp/EFDB/find_ef_s1.php

IPCC Guidelines: Emission factors are included in the 1996 guidelines. IPCC factors are intended for national-level emission estimates. Emission factors are presented for different geographical regions, including a single emission factor for the U.S. and Canada. The source for this data is the October 1992 U.S. EPA Report, *US Anthropogenic Methane Emissions in the United States. Estimates for 1990: Report to the Congress.*

SANGEA

SANGEA is an automated, electronic data management information system. It is owned by API and was designed to assist petroleum companies with estimating, managing and reporting greenhouse gas (GHG) emissions. It can also be used to track energy consumption and criteria pollutant emissions. SANGEA was developed by ChevronTexaco Corporation, with the assistance of Battelle experts. In June of 2004, ChevronTexaco donated ownership of SANGEA to API to make it available free of charge to the entire oil and gas industry as a standardized method of GHG emissions estimation and inventorying

<http://ghg.api.org/home.asp>

Sources of Oil and Gas Air Pollution

A variety of **air contaminants** are emitted throughout the oil and gas development process, and these compounds are released from a number of sources:

- Blowouts
- [Condensate tanks](#)
- [Construction activity](#)
- [Dehydrators](#)
- [Engines](#)
- [Flaring](#)
- [Fugitive emissions](#)
- [Pits](#)
- [Vehicles](#)
- [Venting](#)

<http://www.earthworksaction.org/airpollutionsources.cfm#VENTING>

Other Resources:

1. American Petroleum Institute (API). *Methane and Carbon Dioxide Emission Estimates from U.S. Petroleum Sources*, January 1997.
2. Canadian Association of Petroleum Producers (CAPP). *Global Climate Change Voluntary Challenge Guide*, June 2000.
3. E&P Forum [more recently named the Offshore Gas Producers (OGP)]. *Methods for Estimating Atmospheric Emissions from E&P Operations*, September 1994.
4. Emission Inventory Improvement Program (EIIP). *Guidance for Emissions Inventory Development*, 1999.
5. US Environmental Protection Agency (EPA). *Methane Emissions from the U.S. Petroleum Industry*, February 1999.
6. Gas Research Institute (GRI) and EPA. *Methane Emissions from the Natural Gas Industry*, June 1996.
7. Intergovernmental Panel on Climate Change (IPCC). *Greenhouse Gas Inventory Reference Manual: IPCC Guidelines for National Greenhouse Gas Inventories*, Volume 3, 1997.
8. Canadian Petroleum Association (CPA). *A Detailed Inventory of CH₄ and VOC Emissions from Upstream Oil and Gas Operations in Alberta*, Volumes I-III, March 1992.
9. US Department of Energy (DOE). *Instructions for Form EIA 1605 Voluntary Reporting of Greenhouse Gases*, 1997.
10. US Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources*, AP-42, (GPO 055-000-005-001), 2000.

Reporting Methodologies:

API/Batelle

IPIECA

Principles:

- Relevance
- Completeness
- Consistency
- Transparency
- Accuracy

Setting Boundaries for Emissions Reporting—Upstream, Downstream, Chemicals
Designing an Inventory to Monitor Performance
Identification of Industry GHG Emissions
Evaluation of Industry GHG Emissions
GHG Emissions Reporting
Inventory Assurance Processes

OGP

WRI/WBCSD

Accounting and Reporting Principles:

Relevance—GHG report contains useful information to both inside and outside users; select appropriate inventory boundaries, including organization structures, operational boundaries, and business contexts.

Completeness—compile all relevant emissions sources to create a comprehensive inventory; do not define a minimum accounting threshold stating that a source not exceeding a certain size can be omitted for the inventory, as it is not compatible with the completeness principle.

Consistency—to produce comparable data over time, there must be consistent application of accounting approaches, inventory boundary, and calculation methodologies.

Transparency—the degree to which the inventory is disclosed in a clear, factual, neutral, and understandable manner lends external verifiers to attest to the credibility of the inventory.

Accuracy—quantification processes should be conducted in a manner that minimizes uncertainty.

CEC Evaluation of Oil and Gas Sector GHG Emissions Estimation and Reporting.