

GREENHOUSE GAS REPORTING



Approaches to Greenhouse Gas Emissions Estimation for the Oil and Natural Gas Industry

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Karin Ritter, API

Reid Smith, BP

Terri Shires, URS

Miriam Lev-on, The LEVON Group



A Decade of Initiatives ...

- Petroleum Industry Guidelines for Reporting GHG Emissions
- Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry (API GHG Compendium)
- Addressing Uncertainty in Oil & Natural Gas Industry Greenhouse Gas Inventories
- Petroleum Industry Guidelines for GHG Emission Reduction Projects



Protocol Status

- **US EPA Greenhouse Gas Reporting Program (GHGRP) -Subpart W**
 - Expanded requirements in November 2010 to include petroleum and natural gas systems.
 - Multiple amendments in 2011
- **California Air Resources Board (CARB) - 2011 amendments**
 - Attempts to follow EPA reporting rule, with some more stringent requirements
- **Western Climate Initiative**
 - Attempts to harmonize with the EPA reporting rule
 - Partner states are expected to adopt an incorporate-by-reference rule
- **API Compendium (2009)**
 - Incorporates published emission factors and industry accepted estimation methods

General Programs Comparison

	EPA GHGRP	CARB	WCI
Scope of Operations	<ul style="list-style-type: none"> • Excludes gathering lines and booster stations. • Includes portable combustion sources only for production and distribution. • Includes flares only for production. 	<ul style="list-style-type: none"> • Includes natural gas booster stations. • Includes flares for all upstream operations 	<ul style="list-style-type: none"> • Currently does not address upstream oil & gas sources. • WCI provided comments to EPA during the development of Subpart W rules.
Gases Reported	CO ₂ , CH ₄ , N ₂ O, SF ₆ , HFCs, PFCs, and other fluorinated compounds	<ul style="list-style-type: none"> • Vary by sector. • For Oil & Gas operations reporting of CO₂, CH₄, and N₂O for major combustors only 	<ul style="list-style-type: none"> • Vary by sector and by state. • For all combustion devices, requires reporting of CO₂, CH₄, and N₂O

General Programs Comparison, continued

	EPA GHGRP	CARB	WCI
Threshold	25,000 tonnes CO ₂ e starting in 2010	10,000 tonnes CO ₂ e from stationary combustion starting in 2009	10,000 tonnes CO ₂ e starting in 2010
Reporting Due Date	<ul style="list-style-type: none"> • Annually on 3/31. • Extended to 9/30/2011 for the initial year • Extended to 9/28/2012 for some Subpart including Oil and Natural Gas Systems. 	Annually on April 10th or June 1st depending on the industrial sector	Annually on April 1st but may vary with state specific requirements
Validation & Verification	<ul style="list-style-type: none"> • Internal validation; • EPA will conduct data checks and audits for verification 	Requires 3 rd Party Verification	Requires 3 rd Party Verification

Stationary Combustion: EPA GHGRP

CO₂ Emissions:

Tier 1:

- Fuel use records
- Default HHV
- Default EF

Tier 2:

- Fuel Usage (Monthly records)
- Fuel Analysis (Monthly / weekly, HHV)
- Default EF

Tier 3:

- Fuel use (metered directly)
- Fuel Analysis (carbon content)

Tier 4:

- Hourly Continuous Emissions Monitoring System (CEMS) Measurement

Increasing Data and Reporting Requirements

CH₄ and N₂O Emissions:

Applies default emission factor to quantity of fuel used (in units of energy content)

Combustion Emission Comparison

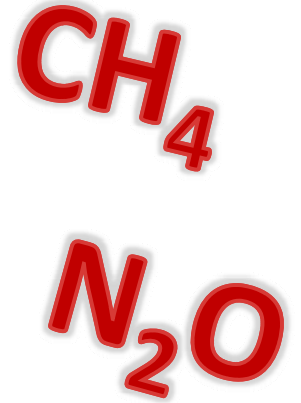
Tier	CARB	WCI
1	Fuel use combined with default EFs based on fuel consumption rate or fuel energy input	EPA Tier 1 approach may only be used at a facility not subject to verification
2	Same as EPA approach, though more frequent HHV determinations for natural gas	EPA approach may be used for natural gas or distillate fuel oil at a facility not subject to verification
3	Same as EPA approach, though more frequent analyses	EPA approach must be used for max. heat rate capacity > 250 MMBtu/hr or located at a facility subject to verification.
4	Consistent with EPA requirements	Same requirements as EPA

API Compendium Combustion GHG Emissions Methods

- Fuel use combined with default EFs
- Fuel use combined with manufacturer EFs
- Fuel use combined with site-specific EFs from fuel composition
- Engineering calculations/ estimates
- Monitoring over a range of conditions and deriving emission factors
- Periodic or continuous monitoring of emissions or parameters for calculating emissions

Combustion Emission Comparison: CH₄ and N₂O

- **EPA GHGRP:** Applies default emission factors to the quantity of fuel used.
- **CARB:** Consistent with EPA approach, though measured HHV must be used if available. A facility may apply approved source-specific EFs.
- **WCI:** Consistent with EPA approach. A facility may apply approved source-specific EFs.
- **API Compendium:** Provides emission factors for different combustion equipment and fuels



Vented CH₄ Emission Comparison

	EPA GHGRP	API Compendium	CARB
Tanks	<ol style="list-style-type: none"> 1. Modeling 2. Sample separator oil composition and pressure 3. Assume all CH₄ and CO₂ from oil and gas compositions are emitted. 4. Assume all CH₄ and CO₂ in oil phase is emitted. 5. Apply EF 	Options: <ul style="list-style-type: none"> •Published EFs or simple correlation •Correlation equation •Process simulation / modeling •Measurement 	<ul style="list-style-type: none"> • The operator who is subject to 40 CFR §98.233(j) must use the calculation methodologies in 40 CFR §98.233(j).
Dehys	<ol style="list-style-type: none"> 1. Modeling 2. Default emission factor 3. Material balance approach for desiccant dehydrators 	Options: <ul style="list-style-type: none"> •Published EFs •Modeling •Test data •Material balance approach for desiccant dehys 	<ul style="list-style-type: none"> • Excludes use of EPA Method 2 • Modified calculation for desiccant dehys

Fugitive CH₄ Emission Comparison

EPA GHGRP	API Compendium	CARB
<p>Subpart W – 98.233(r) applies average component counts per type of equipment and default EFs</p>	<p>Options:</p> <ul style="list-style-type: none"> ▪ Published facility level EFs ▪ Published equipment level emission factors ▪ Published component level emission factors 	<p>References EPA method and factors</p>
<p>Subpart W – 98.233(q) applies leak-based EFs to leaking components determined from survey</p>	<p>Options:</p> <ul style="list-style-type: none"> ▪ Published leak-based EFs ▪ Engineering calculations ▪ Monitoring over a range of conditions and deriving emission factors (e.g., extrapolating to the population from a subset) 	<p>References EPA method and factors</p>

Conclusions

- The oil and natural gas industry has been active in GHG reporting for over a decade
 - API Compendium provides industry with robust guidelines for developing GHG inventories
 - Compendium presents varied methods to allow broad use based on data availability
- API Compendium served as a source reference for the EPA GHGRP
- California and WCI programs have been amended to align with EPA GHGRP
 - State programs are more restrictive due to their foundation for cap and trade

Thank you!

For additional information:

Karin Ritter, API

ritterk@api.org

(202) 682-8472

Terri Shires, URS

terri.shires@urs.com

(512) 419-5464

