



# Oil & Gas Exploration & Production and Natural Gas Gathering & Processing Greenhouse Gas Accounting Protocol – Final Project Plan

FINAL DRAFT September 9, 2008 FINAL DRAFT

## Overview

The Western Regional Air Partnership (WRAP) proposes the following project plan for the New Mexico Environment Department (NMED) and the California Air Resources Board (CARB). The project work by staff from the WRAP, through the Western Governors' Association (WGA) for CARB and NMED, will develop a protocol for reporting greenhouse gas (GHG) emissions from the field operations of the Oil & Gas sector, specifically, exploration and production activities, as well as gas processing plants and the operations of collection systems delivering oil and gas products to processing and refining facilities. There are multiple deliverables for this project, including a voluntary reporting protocol for review and adoption by the The Climate Registry (TCR). In addition, New Mexico and California will use products from this project to develop GHG reporting regulations as part of the Western Climate Initiative. Further, the protocol will be a resource for states, O&G producers, and others across the region. With support from a technical contractor, there will be 3 major products developed through this project:

- 1) Background and Scoping paper - for field operations of the O&G sector, including direct and indirect GHG emissions sources in exploration and production, gas processing plants and the operation of collection systems delivering oil and gas products to processing and refining facilities, the project will develop a background and scoping paper addressing the following and providing options and recommendations.
  - Overviews of these sectors in North America and within the jurisdictions of the Western Climate Initiative.
  - Comprehensive cataloguing, description and prioritization of GHG emissions by source from oil & gas field operations and gas processing plants, including:
    - Direct and indirect emissions (i.e. Scope 1 and Scope 2)
    - Combustion, fugitive, vented, mobile source, and stationary source emissions
    - All six Kyoto GHGs (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride)
  - An examination of current GHG accounting methodologies, data and emission factors. Based on published literature, describe current best practice emissions estimation methods for these emissions sources, and the origin of these methods.
  - For each emissions estimation method, apply a rating scale to classify its accuracy and precision, and describe the monitoring, measurement or other data and level of effort required to implement them.
  - Reporting boundary considerations within the sector (as they relate to existing TCR boundary requirements), including:
    - Overview of ownership arrangements, including joint ventures and co-located facilities
    - Control versus equity share reporting
    - Lease and service contract arrangements
    - Options for installation/facility definitions

- Potential geographic boundary considerations.
  - GHG emissions reporting considerations, including:
    - Carbon dioxide equivalence
    - Small source considerations
    - Efficiency metrics
    - Other optional reporting
  - Verification issues specific to these O&G sources.
- 2) Technical Review of High-tier Emissions Quantification Methods - a technical review of emissions quantification methods for critical field sources identified in the background and scoping paper will be prepared, specifically designed to inform and guide the process of developing mandatory reporting requirements by partner jurisdictions in the Western Climate Initiative. For the significant land-based and offshore GHG sources, this technical review paper will:
- Prioritize sources for mandatory reporting, considering the magnitude of known or projected emissions.
  - Evaluate existing GHG accounting strategies and available data and emission factors. Discuss limitations inherent in currently available accounting methodologies, emission factors and data, focusing on the largest GHG sources.
  - Identify current methodological deficiencies for these high-priority sources; propose and discuss high-tier alternative sampling and/or analytical methodologies designed to address these deficiencies and improve emissions data quality.
- 3) Protocol Draft and Preparation - a comprehensive voluntary reporting and verification protocol will be prepared that, in conjunction with TCR's existing General Reporting Protocol and General Verification Protocol, provides comprehensive guidance to companies to quantify and report their emissions from oil and gas exploration and production as well as gas processing. To the degree possible, the protocol will be modeled on the format used in existing TCR protocols.
- 3 to 4 sequential draft versions of the voluntary protocol will be prepared and reviewed.
  - The assumptions, methods, and uncertainties underlying the protocol will be documented.
  - The public comment period for TCR for the draft voluntary protocol will require preparation of a summary document of comments and responses.

### **Technical Workgroup and Advisory Group**

Development of the protocol will be primarily handled by a focused technical workgroup of 15-20 people, to be composed of experts from public sector agencies, non-governmental organizations, industry, and environmental advocacy groups. The workgroup will be responsible for the detailed review of the technical documents and drafting of the protocol. The technical workgroup will be formed by invitation. The protocol project Steering Committee, composed of NMED, CARB, and TCR, will select the Technical Workgroup (TWG) members. The TWG will be formed in consultation with public sector agencies, non-governmental organizations, as well as industry and environmental advocacy groups.

The TWG will meet as often as biweekly by conference call, and less frequently in person, during the November 2008 through April 2009 time frame. TWG members will need to review and comment on technical documents in a timely manner, and communicate with colleagues in their sector. The Steering Committee will also seek external expertise for specific technical issues as they are identified by the TWG.

In addition, a Protocol Advisory Group (PAG) will be formed. The PAG is open to anyone interested in participating in the development and review of the protocol. PAG members will receive periodic notices of the progress of the TWG and have several opportunities to review and comment as the protocol is developed.

The contact person for those interested in being involved in the PAG is:

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### **Protocol Development Process**

**Timeline** - the following table represents the basic project schedule. Exact dates for meetings and deadlines for deliverables will be determined, and are subject to change.

September-October 2008

- Release project plan, update project web page, and notify interested parties
- Form Technical Workgroup (TWG) & Protocol Advisory Group (PAG)
- Release Request For Proposal, issue contract for protocol technical support and preparation
- Select technical support contractor, finalize contractor work plan, and begin preparation of background and scoping paper

November 2008

- Initial TWG meeting(s) (not more than 2, one in person and additional by phone if needed)
- Initial draft of Background and Scoping Paper prepared by contractor and distributed to TWG

December 2008

- TWG evaluation of draft Background and Scoping Paper; contractor revision and release for PAG and stakeholder review
- Initial draft of Technical Review of High-tier Emissions Quantification Methods prepared by contractor and distributed to TWG

January – February 2009

- TWG evaluation of initial draft Technical Review of High-tier Emissions Quantification Methods; contractor revision and release for PAG and stakeholder review (January)
- Complete final Background and Scoping Paper (January) and final Technical Review of High-tier Emissions Quantification Methods (end of February) in consultation with TWG
- Initial draft of voluntary reporting and verification protocol prepared and distributed to TWG
- TWG meetings to discuss draft voluntary protocol issues (not more than four, including one in person)

March - April 2009

- TWG review and comment on high-tier emission quantification methods for on-shore oil and gas activities for use by the Western Climate Initiative Partners in support of GHG emissions reporting rule development.
- Subsequent draft(s) of voluntary reporting and verification protocol prepared and distributed to TWG (early March)
- TWG evaluation of subsequent drafts (meetings as needed, telephone calls)
- Contractor completes draft Protocol for public release in consultation with the TWG; public release upon approval by TCR Board of Directors
- Presentation of Protocol in person at one public meeting
- Public comment period begins

May - June 2009

- Contractor organizes all public comments, summaries and suggested revisions

- Final TWG meeting to review comments (in person)
- Contractor prepares draft final Protocol
- Protocol presented to TCR Board of Directors for finalization and adoption

### **Steering Committee and Project Staff - Roles and Responsibilities**

The New Mexico Environment Department and California Air Resources Board are providing funding and oversight for the project. NMED and CARB will use the protocol to develop reporting regulations. The products from this project will be used to develop GHG reporting requirements under the Western Climate Initiative.

TCR is providing oversight and guidance for the protocol development process and will submit the draft protocol for adoption by their organization.

Work of the project staff from WRAP is directed by a steering committee comprised of NMED, CARB, TCR, and WRAP representatives. WRAP staff will provide management of two consultants and the coordination of the technical workgroup and protocol advisory group.

WRAP project staff:

Tom Moore, Air Quality Program Manager, WGA  
 Lee Gribovicz, Air Quality Project Manager, WGA

- Project development and coordination
- Develop, issue, award, and manage contract for technical support contractor
- Meeting and phone call organization, arrangements, and logistics
- Delivery of project results via web page (<http://www.wrapair.org/ClimateChange/GHGProtocol/index.html>)

The contractor will receive the following support in technical meetings:

- WGA will provide contracted facilitator services for all meetings and calls of the TWG, PAG and any public meetings.
- WGA will provide conference call services and arrange in-person meetings.
- WRAP staff will prepare and circulate meeting notes from these meetings and calls.

Outside contractor support through WGA contracts will be responsible for the following activities related to the support of the TWG and PAG:

- Preparation and participation by the principal and key staff involved in the contractor effort in all TWG, PAG and public meetings, in accordance with the project schedule below and the deliverables listed above.
- Monthly status reports on hours used and deliverables for WRAP staff and the Steering Committee.

## Appendix A

### Protocol Development Work

GHGs are produced and emitted by various sources during the exploration, well development, production, gas processing and site abandonment phases. The American Petroleum Institute (API) categorizes the emissions sources of all oil and gas operations (including refineries) into five classifications:

- A. Combustion Devices—includes stationary (burners, flares) and mobile (trucks, ships) sources
- B. Point Sources—includes emissions from stacks, vents, ducts
- C. Non-point Sources—includes fugitive emissions of methane, wastewater treatment facilities, and other sources involved in waste handling
- D. Non-routine activities—activities associated with non-scheduled maintenance or emergency operations
- E. Indirect emissions—emissions associated with company operations but physically occurring elsewhere, such as purchased electricity.

The following is a listing of the process of oil and gas exploration and production, and the possible sources of greenhouse gas emissions associated with them:

1. **Exploration Phase: GHG Emissions:** Depending on method used, CO<sub>2</sub> emissions from truck motors used in vibroseis or the use of explosive devices.
2. **Well Development Phase:** see below:
  - A. **Clearing Area for the Well Pad: GHG Emissions:** CO<sub>2</sub> combustion emissions from fuel used in trucks. Additionally, one-time and potentially long-term effects could include lost carbon sinks due to surface and vegetation disturbance.
  - B. **Constructing Roads:** Generally, there are two types of roads:
    1. Access Roads –shorter roads that lead the resource road to the individual well pad
    2. Resource Roads--longer, wider, more arterial roads that feed into the access roads

*GHG Emissions:* Combustion emissions, CO<sub>2</sub>, from fuel used in trucks. Additionally, one-time effects could include lost carbon sinks due to surface and vegetation disturbance.
  - C. **Rigging Up and Drilling: GHG Emissions:** CO<sub>2</sub> combustion emissions from fuel used by rigs. Many rigs are powered with electricity. Therefore, indirect CO<sub>2</sub> emissions could occur from the fuel input used in the electrical generating unit.
  - D. **Drilling Fluids: GHG Emissions:** Possible CO<sub>2</sub> and CH<sub>4</sub> from flaring or venting of the vapors associated with the drilling fluids
  - E. **Casing: GHG Emissions:** Although likely to be insignificant, possible CH<sub>4</sub> fugitive emissions leaks.
  - F. **Well Completion and Testing (drilling is complete):** CO<sub>2</sub> and CH<sub>4</sub> may be emitted during the process, depending on which method is used. Fugitive emissions of methane from initial rock fracturing, from flaring, and from compressor stations may occur during this stage.
    1. **Fracturing: GHG Emissions:** Fugitive CH<sub>4</sub> emissions, CO<sub>2</sub> from fuel used in injection machinery. Diesel trucks are often used.
    2. **Flaring: GHG Emissions:** CO<sub>2</sub> and CH<sub>4</sub> However, in California, flaring is allowed only in specific circumstances and it is on a case by case basis. The company must apply for a permit to flare, which is issued by the county or local air board.

3. **Venting:** *GHG Emissions:* Because venting in California is not allowed, CO<sub>2</sub> or CH<sub>4</sub> from fugitive emissions could occur. All tanks are covered tanks, and often, a unit will have a vapor recovery system attached. Also important to note is that compliance with venting procedures could be a critical factor in the estimation of GHG emissions. Specifically,
4. **Compressor Engines:** *GHG Emissions:* CO<sub>2</sub> associated with combustion of fuel input (diesel or natural gas) into the compressor engine.
5. **Tubing Installation:** *GHG Emissions:* Fugitive CH<sub>4</sub> emissions and CO<sub>2</sub> emissions from fuel combustion associated with installation of equipment.

### 3. Primary and Secondary Production Phases:

- A. **Compressor Equipment:** *GHG Emissions:* CO<sub>2</sub> and CH<sub>4</sub> associated with combustion of fuel input (diesel, natural gas) by the compressor equipment.
- B. **Secondary and Tertiary Recovery:** *GHG Emissions:* Fugitive CH<sub>4</sub> if gas is reinjected; CO<sub>2</sub> from combustion emissions of injection equipment. Fugitive emissions of CO<sub>2</sub> if used as an injectable fluid.
- C. **Wellsite Visits:** *GHG Emissions:* CO<sub>2</sub> from fuel combustion during truck visits
- D. **Wellsite facilities:** Two pieces of important equipment at the well site are the separator and the dehydrator. With these two pieces of equipment, there are sometimes smaller flares to prevent pressure buildup. There are also sometimes disposal wells or evaporation ponds installed next to the well pad.
  1. **Separators** – see below.
    - a. **Crude Oil Separation (oil recovery only):** *GHG Emissions:* Fugitive CH<sub>4</sub> emissions and CO<sub>2</sub> emissions associated with separation equipment.
    - b. **Natural Gas Conditioning (natural gas recovery only):** *GHG Emissions:* CO<sub>2</sub> emissions that may be vented after separated from the gas stream
  2. **Dehydrator:** *GHG Emissions:* CO<sub>2</sub> or CH<sub>4</sub>
    - a. **Wastewater Disposal:** *GHG Emissions:* CO<sub>2</sub>, CH<sub>4</sub>, and VOCs
  3. **Other Facilities:** *GHG Emissions:* CO<sub>2</sub>, CH<sub>4</sub>, others.
- E. **Leaks:** *GHG Emissions:* CH<sub>4</sub>, CO<sub>2</sub>, and other VOCs
- F. **Accidental Acute Release:** *GHG Emissions:* CH<sub>4</sub>, CO<sub>2</sub> that is a natural part of the gas
4. **Site Abandonment** *GHG Emissions:* CO<sub>2</sub> and CH<sub>4</sub> from venting
5. **Gas Processing** *GHG Emissions*

## Sources to Consider in Developing the Protocol

The most recent WRAP O&G criteria pollutant emissions inventory source activities were combined with the API source list described above. Development of the protocol will begin by considering GHG emissions by all sources in the combined table below.

| <b>EXPLORATION AND PRODUCTION</b>                                  | <b>CO<sub>2</sub></b> | <b>N<sub>2</sub>O</b> | <b>CH<sub>4</sub></b> |
|--|-----------------------|-----------------------|-----------------------|
| <b>COMBUSTION SOURCES – Stationary Devices</b>                     |                       |                       |                       |
| Boilers/Steam Generators   |                       |                       |                       |
| Miscellaneous gas fired heaters or boilers                         |                       |                       |                       |
| Heaters/Treaters   |                       |                       |                       |
| Oil well heaters   |                       |                       |                       |
| Gas well heaters   |                       |                       |                       |
| Internal Combustion (IC) Engines                                   |                       |                       |                       |
| Lateral/wellhead compressor engines                                |                       |                       |                       |
| Drilling Rigs  |                       |                       |                       |
| CBM pump engines   |                       |                       |                       |
| Salt water disposal engines  |                       |                       |                       |
| Artificial lift engines (pumpjacks)                                |                       |                       |                       |
| Vapor recovery unit (VRU) compressor engines                       |                       |                       |                       |
| Miscellaneous gas fired engines                                    |                       |                       |                       |
| Turbines   |                       |                       |                       |
| Large Compressor Stations  |                       |                       |                       |
| Flares   |                       |                       |                       |
| Flaring  |                       |                       |                       |
| Gas well completions   |                       |                       |                       |
| Incinerators   |                       |                       |                       |
| <b>COMBUSTION SOURCES – Essential Mobile Sources</b>               |                       |                       |                       |
| Planes/helicopters   |                       |                       |                       |
| Supply boats, barges   |                       |                       |                       |
| Other company vehicles   |                       |                       |                       |
| <b>COMBUSTION SOURCES – Indirects</b>                              |                       |                       |                       |
| Electricity imports  |                       |                       |                       |
| Process heat/steam imports   |                       |                       |                       |
| <b>VENTED SOURCES – Process Vents</b>                              |                       |                       |                       |
| Gas sweetening processes   |                       |                       |                       |
| Natural gas processing plants                                      |                       |                       |                       |
| Amine units  |                       |                       |                       |
| Dehydration processes  |                       |                       |                       |
| Dehydrators  |                       |                       |                       |
| <b>VENTED SOURCES – Other Venting</b>                              |                       |                       |                       |
| Tanks  |                       |                       |                       |
| Oil well tanks - breathing losses, gas venting, flashing emissions |                       |                       |                       |
| Gas well tanks - breathing losses, gas venting, flashing emissions |                       |                       |                       |
| Gas well truck loading   |                       |                       |                       |
| Oil well truck loading   |                       |                       |                       |
| Pneumatic devices  |                       |                       |                       |

Pneumatic devices  
Chemical injection pumps  
Plunger lift operations  
Well testing  
Venting  
Exploratory drilling

**VENTED SOURCES – Maintenance/Turnarounds**

Vessel blowdown  
Well workovers  
Workover rigs/frac rigs  
Compressor starts  
Compressor blowdowns  
Gathering pipeline blowdowns

**VENTED SOURCES – Non-routine Activities**

Pressure relief valves (PRVs)  
Well tests and blowdowns (not flared)  
Blowdowns  
Emergency shutdown (ESD)/ emergency safety blowdown (ESB)

**FUGITIVE SOURCES**

Equipment component leaks  
Oil well fugitive emissions  
Gas well fugitive emissions  
Pipeline/compressor station fugitive emissions  
Landfarms  
Water treatment/water injection facilities

**Emissions Factors for the Oil and Gas Sector**

The emissions factors will be based on the best available information, from literature reviews and from protocol development process participants. These can include site and component-specific emission factors that may not yet have been published or peer-reviewed. The technical workgroup will be responsible for reviewing such factors and decide their appropriate inclusion in the protocol. Potential sources of emission factors include:

- EPA AP-42
- API
- IPCC
- CAPP
- Industry derived

Activity Data Requirements

The best available information about activity data is also critical to developing the protocol, including:

- Number of wells and status (active, closed in)
- Number of wells drilled and well workovers/year
- Compressor stations – size (hp), number of compressors, gas through-put
- Pipeline – type, size, length
- Dehydrators (type and number)
- Other appropriate activity data

Activity Data Sources

The TWG will assess the use of activity data from the following sources:

- EIA
- EPA
- API
- State regulatory agencies (e.g., oil and gas commissions)
- Stakeholders

### **Information Sources**

A. Zahniser, Bureau of Land Management: Characterization of Greenhouse Gas Emissions Involved in Oil and Gas Exploration and Production Operations, Review for the California Air Resources Board, October 2007.

American Petroleum Institute: Toward a Consistent Methodology for Estimating Greenhouse Gas Emissions from Oil and Natural Gas Industry Operations

[http://www.climatevision.gov/sectors/oil\\_gas/pdfs/ghg\\_synopsis.pdf](http://www.climatevision.gov/sectors/oil_gas/pdfs/ghg_synopsis.pdf)

U.S. Environmental Protection Agency, Office of Compliance Sector Notebook: Project Profile of the Oil and Gas Extraction Industry, October 2000.

<http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/oilgaspt1.pdf>

2007 Draft U.S. Greenhouse Gas Inventory Report Draft Inventory Of U.S. Greenhouse Gas Emissions And Sinks: 1990-2005, February 2007. <http://epa.gov/climatechange/emissions/usinventoryreport07.html>

Canadian Association of Petroleum Producer, Technical Report on A National Inventory of Greenhouse Gas, Criteria Air Contaminant, and Hydrogen Sulphide Emissions by the Upstream Oil and Gas Industry, Volume 4.

<http://www.capp.ca/raw.asp?x=1&dt=NTV&e=PDF&dn=86224>