



ITRC PROJECT PROPOSAL:

Protocols for the Quantification of Methane Emissions from Natural Gas Processing and Transmission Facilities

PROPOSAL DATE:

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Proposal Contact:

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Call for Proposals Topical Area

Greenhouse gas emission tracking and reporting (GHG)
Technologies and approaches for measuring, assessing, tracking, monitoring, modeling, and/or reporting greenhouse gas emissions from various industry sectors.

Problem Statement (why is this project necessary and relevant to ITRC's purpose & mission¹?)

There is now broad international consensus that global greenhouse gas emissions must be stabilized and then reduced to levels that will prevent "dangerous anthropogenic interference with the climate system" (United Nations Convention on Climate Change – UNFCCC). It is also apparent that establishing a price or cost to greenhouse gas (GHG) emissions will be essential to planned emission reduction strategies. To that end, cap and trade programs have been initiated in the European Union (EU Emissions Trading System) and United States (e.g. the Regional Greenhouse Gas Initiative and the Western Climate Initiative - WCI). Cap and trade is a market or monetary based approach where GHG emissions are capped at a level that declines over time. Those entities participating in a cap and trade system can trade allowances (a permit to emit a ton of carbon dioxide equivalence). Central to the success and integrity of a cap and trade system is an accurate accounting methodology for all significant GHG emissions. Whether they pursue cap and trade or more traditional command and control approaches, regulatory bodies will be required to verify facility GHG reports, ensure that a ton of carbon is really a ton of carbon (in effect verifying the value of each ton of carbon traded) and provide reliable evaluation of the success of their programs for reducing GHG emissions locally, nationally and internationally.

Although much attention has been focused on carbon dioxide emissions, methane is second only to carbon dioxide as a contributor to global warming. In fact on a per molecule basis methane exhibits about 21 times the warming potential of carbon dioxide. While atmospheric methane concentrations have more than doubled over the past two centuries, modest decreases in anthropogenic emissions (on the order of 10-20%) would stabilize methane concentrations at 1990 levels. As the primary component of natural gas methane is also an important and valuable energy source; thus the recovery and utilization of methane can have positive economic benefits.

A significant fraction of anthropogenic methane emissions are from the natural gas industry, and a large fraction of these emissions are fugitive. By their nature, diffuse fugitive emissions are very difficult to

¹ **ITRC Purpose:** To advance innovative environmental decision making
ITRC Mission: Develop information resources and help break down barriers to the acceptance and use of technically sound innovative solutions to environmental challenges through an active network of diverse professionals.

measure and quantify accurately. This is especially true at large industrial facilities such as natural gas processing plants and compressor stations where there are thousands of components (values, flanges, regulators, piping, seals etc.) that may be leaking.

Traditional fugitive emission quantification methods (such as U.S. EPA Method 21) have relied upon periodic labor intensive screening of as many of these components as possible - personnel safety is an important consideration. Component screening leak values (ppm VOC) are generated using a portable device (typically a handheld organic vapor analyzer). A component specific emission factor or correlation equation is then applied to calculate emissions. While this methodology may be adequate to produce national GHG inventories it is certainly not rigorous enough to quantify facility specific emissions under a cap and trade program. The relatively high level of uncertainty associated with this approach is due in large measure to the question of the applicability of experimentally derived emission factors and correlation equations to facility specific operational parameters. Leak rates are related to many factors such as system operating pressure, equipment age and the effectiveness of any existing facility leak detection and repair programs.

Facility operators need a reliable and accurate sampling methodology whereby they can identify and quantify leaks and subsequently develop a leak mitigation program that targets high priority leaks. Many technological methane mitigation strategies have been developed by programs such the U.S. EPA Natural Gas STAR Program (Best Management Practices) and the Methane to Markets Partnership. Facility operators need emissions information that will allow them to identify and implement the most appropriate and cost-effective mitigation strategies.

Additionally, regulators need a reliable and accurate emission measurement methodology with which they can quantify facility methane emissions and subsequent GHG reductions for cap and trade or command and control regulations. The natural gas processing and transmission sector is an area where significant GHG emission reductions can be achieved utilizing existing technology. However, realizing this potential requires the application of accurate quantification methodologies.

The central goal of this project is to address both of these methodological needs. Given the fact that numerous states (e.g. the Western Climate Initiative) and the federal government are poised to begin ambitious regulatory programs to address greenhouse gas emissions and global warming it is critical that methods to quantify emissions and evaluate emission reduction strategies be developed and disseminated as widely as possible. The success of efforts to reduce GHG emissions depends critically on the availability of reliable and accurate GHG emissions quantification methodologies.

Proposed Scope to Address Problem (what is the approach for this project?)

We propose to evaluate, develop and formalize two methodological protocols to identify and quantify fugitive methane emissions from complex sources such as natural gas compressor stations and processing plants. One sampling and quantification protocol would be used by facility operators to first identify and quantify methane fugitive emissions at their facilities. The resulting data would then be used by facility staff to identify and prioritize the most effective greenhouse gas mitigation efforts. The U.S. EPA has previously evaluated the High Volume Collection System (HVCS) for quantifying fugitive organic vapor leaks. This initial EPA study concluded that "HVCS may have a very significant role to play in applications where rapid, cost effective, on-site leak quantifications are important". This ITRC project would extend this initial work and develop a formal HVCS sampling protocol for use at natural gas facilities. This objective would be carried out through a series of field sampling initiatives at natural gas processing and transmission complexes.

A second sampling protocol focused on the quantification of whole facility fugitive methane emissions would also be developed. Tracer techniques have been used to quantify gas emissions from numerous complex and large sources. An inert gaseous tracer is released at a know rate from the source area. Tracer and methane concentrations are subsequently measured in downwind traverses of the source plume using real-time instrumentation mounted in a vehicle. This methodology would be used by regulatory agencies, facility operators and third party contractors to accurately quantify facility fugitive emissions and guide GHG mitigation activities for regulatory compliance and cap and trade allowance trading purposes. A primary goal of this process would be to ensure that this sampling methodology provides the rigorous and reliable emissions data essential for inclusion in a cap and trade regime.

Targeted Users (who will use products generated by this project?)

We anticipate that there are multiple users who would employ the Protocol and Guidance products generated by this project. Facility operators in the natural gas production and transmission industries will soon be required to report greenhouse gas emissions from their facilities. Furthermore, these facilities will be required to reduce facility GHG emissions as part of state, regional and national regulatory programs to address climate change. Thus, target users include the natural gas industry and the ancillary industries carrying out compliance related activities (e.g. verification bodies, environmental service contractors). These stakeholders will use both protocols - the facility screening methodology and the whole site emissions technique. They will use these methods to identify major methane emissions, target mitigation efforts, and ensure compliance with all state and federal mandatory reporting and emission reduction requirements.

As mandatory state and federal greenhouse gas reporting programs are established, regulatory agencies will be tasked with compliance and enforcement responsibilities. Accurate GHG emissions quantification methodologies are required to enforce regulatory GHG reporting requirements and ensure that provisions of chosen regulatory strategies are met.

There are over 1200 natural gas compressor stations located in all states, with the exception of New Hampshire and Vermont. Additionally, there are over 500 natural gas processing plants that tend to be concentrated in the oil and gas producing regions of the U.S. Thus the protocols which we propose to develop will be important resources for essentially all states. The US EPA has been tasked by Congress with developing a mandatory GHG reporting regulation and it is widely anticipated that a draft of this regulation will be released very soon. Thus, there is a pressing need for improved quantification methodologies for fugitive GHG emissions.

Summary of Deliverables (primary project product(s))

The primary deliverables will be technical/regulatory guidance documentation and training materials designed to provide all interested stakeholders with the confidence, knowledge and skills required to quantify fugitive greenhouse gas emissions from large and complex industrial sources.

The guidance will provide facility operators and their contractors with detailed information concerning the instrumentation and sampling techniques required to screen their facilities and identify and quantify all significant fugitive emissions. This document will also provide guidance for prioritizing deployment of emission mitigation technologies and assigning available government resources to target cost effective GHG emissions mitigation.

In addition, guidance will be developed to provide regulatory personnel and verification bodies (both private contractors and public officials) with details concerning instrumentation and a sampling methodology whereby facility emissions and regulatory compliance can be determined.

Finally, training materials will be developed, tested and a training program initiated. This training program will be designed to disseminate the knowledge and methodological products of this project to a wide audience.

Impact (how will this project result in more effective environmental decision making?)

Facility operators will be provided with guidance, formalized protocols and training enabling them to:

1. screen their facility, identify and quantify fugitive methane emissions from all components that are safely accessible.
2. identify high priority leaking components and subsequently formulate and carry out an effective emission reduction campaign
3. quantify whole facility methane emissions and the effectiveness of emissions mitigation efforts

Regulatory agencies and personnel will be provided with guidance which will allow agencies to:

1. institute regulatory methodologies for the accurate determination of fugitive GHG emissions from large and complex sources

2. evaluate compliance with existing and future state and federal GHG reporting regulations at facilities in their jurisdictions
3. quantify and verify fugitive methane GHG emission reductions achieved as part of cap and trade and allowance trading programs, or other regulations

Project Schedule

2010

Team Formation – identify industry participants and secure commitments for facility access during field sampling and methodology development.

Refine Scope of project approach; confirm that proposed methodologies represent the most promising available techniques.

Define deliverable scope and development milestones

2011

Plan field sampling; assign tasks to individual team members

Conduct first field sampling campaign

Evaluate results from first sampling campaign; formalize changes and modifications to sampling approach
Begin preparation of technical and regulatory guidance deliverables

Conduct second field sampling campaign, evaluate results and lessons learned

Plan and begin preparation of outreach and training program and materials

Review and finalize guidance documentation

2012

Finalize training materials and outreach activities

Conduct beta testing of workshop and web-based training

Incorporate necessary programmatic changes and begin outreach training

Release final guidance documentation

Proposed Personnel

Proposed Personnel - Skill Mix of Team Members - Sectors of Team Members Required

Proposed Project Team Leader

- California: Byard W. Mosher, Ph.D.

Air Resources Board, California Environmental Protection Agency

Byard Mosher is a member of both the Steering Committee and Technical Working Group of the WRAP (Western Regional Air Partnership) Oil & Gas Exploration & Production and Natural Gas Gathering & Processing Greenhouse Gas Accounting Protocol project. The WRAP process is designed to inform the Western Climate Initiative Reporting Committee and member states in the development of GHG reporting regulations for the oil & gas industry. He was Air Resources Board (ARB) lead staff for the development of California GHG reporting regulations for the petroleum refining and hydrogen production sectors. Prior to joining ARB in 2007, BWM spent twelve years as a research scientist at the University of New Hampshire (UNH). In this capacity he was involved in the development of GHG sampling methodologies for the natural gas and landfill sectors. He also worked with UNH Cooperative Extension Service to develop GPS training materials and conduct training workshops for Environmental Professionals.

States Interested in Participating

- Representatives of several WCI States, including New Mexico, Arizona, Utah and Oregon, have expressed interest in participating in this project. The WCI States will soon release a draft GHG reporting document to be used by member States to develop specific GHG reporting regulations. Individual team participants have not yet been identified.

Other Organizations Expressing Interest

- We have had discussions with a U.S. EPA representative (active in the Methane to Markets Partnership and the Natural Gas STAR Program) who has indicated that EPA would be very interested in participating in this project.
- The Research Division at ARB is currently in the final stages of instrumenting two sampling vehicles. Personnel in this division have indicated that they are very interested in participating in a field sampling program.
- A private company currently working with ARB Research personnel has indicated that they would be very interested in working with the Team on this ITRC project. This company currently manufactures instrumentation for the determination of gaseous species in the atmosphere

Skill Mix of Team Members Required

- Greenhouse gas emissions reporting regulation development
- Greenhouse gas sampling and quantification
- Greenhouse gas mitigation technology
- Environmental sampling
- Oil and Gas industry engineering and environmental science

Sectors of Team Members Required

- State officials from environmental regulatory agencies
- Natural gas industry members
- Environmental consulting and industry services

Related Work:

The US EPA is currently conducting a multi-year project entitled *Methane Emission Factor Development Project for Select Sources in the Natural Gas Industry*. The EPA staff member who has expressed an interest in participating in this proposed ITRC project has stated that these two projects are complementary and has volunteered to facilitate communication between the two projects.