QUALITY ASSURANCE PROJECT PLAN

Greenhouse Gas (GHG) Emission Factor Development Project

Cooperative Agreement number XA-83376101-0

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1.0 TITLE AND APPROVAL SHEET

1.1 Preface

This Quality Assurance Project Plan is submitted in fulfillment of the U.S. Environmental Protection Agency (EPA) quality assurance project plan requirements of EPA Cooperative Agreement number XA-83376101-0 to the University of Texas at Austin.

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1.2 Quality Assurance Project Plan Approval Sheet

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2.0 TABLE OF CONTENTS

2.1 List of Figures

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2.3 List of Abbreviations

AGA - American Gas Association

API – American Petroleum Institute

CEER – Center for Energy and Environmental Resources at the University of Texas

CO_2 Eq. – Equivalent mass of CO_2 in global warming potential

CPA – Canadian Petroleum Association

EPA – Environmental Protection Agency

GHG – Greenhouse Gas

GOADS - Gulfwide Offshore Activities Database System

GRI – Gas Research Institute

GTI – Gas Technology Institute

GWP – Global warming potential

INGAA - Interstate Natural Gas Association of America

IPCC – Intergovernmental Panel on Climate Change

NGOs – Non-governmental organizations

3.0 PROJECT DESCRIPTION AND MANAGEMENT

3.1 Overview

Methane (CH_4) is the primary component of natural gas and is also a greenhouse gas (GHG), with a 100-year global warming potential (GWP) roughly 21 - 23 times that of CO_2 (IPCC, 1996 and IPCC, 2001). As documented in the U.S. Environmental Protection Agency's *Inventory of Greenhouse Gas Emissions*, released in 2006 (EPA, 2006), emissions from natural gas production, processing, and distribution are among the top ten source categories of greenhouse gas emissions in the United States, expressed on a CO_2 equivalent basis. These emissions arise from "hundreds of thousands of wells, hundreds of processing facilities, and over a million miles of transmission and distribution pipelines" (EPA, 2006). The number and diversity of sources lead to uncertainties in the emissions estimates that are approximately 30% (118.8 Tg CO_2 Eq. per year with a lower bound of 84.3 and an upper bound of 155.5 Tg CO_2 Eq.) (EPA, 2006).

The primary source of information on CH_4 emissions from the natural gas industry is a study conducted for the Gas Research Institute (GRI) and the U.S. Environmental Protection Agency (EPA). While the GRI/EPA Study serves as the basis for most natural gas industry CH_4 emission estimates worldwide, there have been significant changes in the industry since the time the study was performed and opportunities exist for reducing the uncertainties associated with the emission estimates.

The overall goal of the project is to update default CH_4 emission factors for selected processes and equipment used in the natural gas industry that take account of new data collected since the GRI/EPA study and reflect any significant changes in practices or equipment since the GRI/EPA study. The processes and equipment for which GHG emission factors will be evaluated are listed in Table 3-1. The default emission factors will be updated by compiling and synthesizing existing data and by acquiring new emission rate measurement data for selected sources where existing data have unacceptably large uncertainties or are insufficiently representative of current practices or equipment.

Table 3-1. Priority List of Emission Sources for the Development of Emission Factors

Industry Segment	Emissions Sources	Timing of Work
Production	Well Clean Ups	Phase 2
	Completion Flaring	Phase 2
	Well Workovers	Phase 2
	Pipeline Leaks	Phase 2
Processing	Recip compressors (fugitive)	Phase 1
	Cent. Compressors (fugitive)	Phase 1
Transmission and Storage	Recip. Compressors (fugitive)	Phase 1
	Pneumatic Devices (vent)	Phase 1
	Cent. Compressor (fugitive)	Phase 1
	Cent. Compress (storage)	Phase 1
	Meter and Regulating Stations	Phase 1
Distribution	Residential customer meters	Phase 2
	Mains-plastic	Phase 2
	Services-plastic	Phase 2

The project is organized into four tasks:

- **Task 1, Data Synthesis and Gap Analysis:** The purposes of this task are to: (1) identify, compile, and synthesize existing CH_4 emission factor and activity factor data for the source categories listed in Table 3-1: (2) critically review the quality and representativeness of the existing data; (3) recommend and prioritize emission source characteristics for new data collection efforts under Task 3.
- **Task 2, Technical Plan Development:** The purpose of this task is to develop technical work plans and detailed cost estimates for conducting data collection and measurement studies aimed at filling the emission data gaps identified in Task 1. In doing so, we will consider the range of potential activity data metrics that could be used for updating default emission factors and gather preliminary data on relevant metrics to ensure that all the major subgroups of equipment or processes are taken into account.
- **Task 3, Measurements and Analysis:** The purposes of this task are to: (1) execute the technical plans developed in Task 2, contingent on authorization by EPA; and (2) analyze the resulting data to develop new default emission factors and uncertainty estimates for the measured sources.
- **Task 4, Reporting and Dissemination:** The purpose of this task is to report on the default emission factors developed in Tasks 1 and 3 of this study, including the methods used in the process. Reporting and communication with stakeholders will be integrated into all of the tasks and a final reporting will disseminate project results.

3.2 Objectives

This quality assurance project plan will focus on the project's four tasks:

Task 1. Data Synthesis and Gap Analysis
Task 2. Technical Plan Development
Task 3. Measurements and Analysis
Task 4. Reporting and Dissemination

These tasks will include a critical review and gap analysis of existing emission factors, technical protocols, equipment-specific measurement plan updates to the quality assurance plans, reports on updated default emission factors for the source categories identified in the RFP, and a series of meetings and presentations designed to incorporate stakeholder input into the data collection and reporting process.

3.3 Project Schedule

As described in Sections 3.1 and 3.2, the project is divided into four tasks. Task 1 will be performed in the initial 6-9 months. Task 2 will be performed in two Phases, over a 2 year period, beginning approximately 9 months after project initiation. Task 3 will be performed in two Phases, over a 2 year period, beginning approximately 18 months after project initiation. Task 4 will occur over a 6 month period, beginning approximately 3 years after project initiation.

Table 3-2. Estimated Timeline

Action	2007	2008	2009	2010	2011
Task 1 – Data Synthesis and Gap Analysis					
Establish Contract Terms					
Task 1a:Review/Assess Existing Data					
Task 1b:Identify Gaps					
Task 1c:Reporting and Dissemination					
Task 2 – Technical Plan Development					
Task 2a:Research Activity Data Metrics (equipment age, geographic location)					
Task 2b:Statistical Analysis					
Task 2c:Prioritize Sources					
Task 2d:Develop Protocol/QA Plan for Phase 1 *(Processing and Transmission & Storage Sources)*					
Task 2e:Develop Protocol/QA Plan for Phase2 *(Production and Distribution Sources)*					
Task 2f:Review / Comment / Work Shop for Technical Plan					
Task 3 – Measurements and Analysis					
Task 3a:Begin Measurement for Phase 1					
Task 3b:Begin Measurements for Phase 2					
Task 3c:Report for each Measurement Study					
Task 4 – Reporting and Dissemination					
Task 4a:Develop Final Report of Data					
Task 4b:Send Report for Review and Comment					
Task 4c:Incorporate Comments					
Task 4d:Disseminate Report via conferences and workshops					

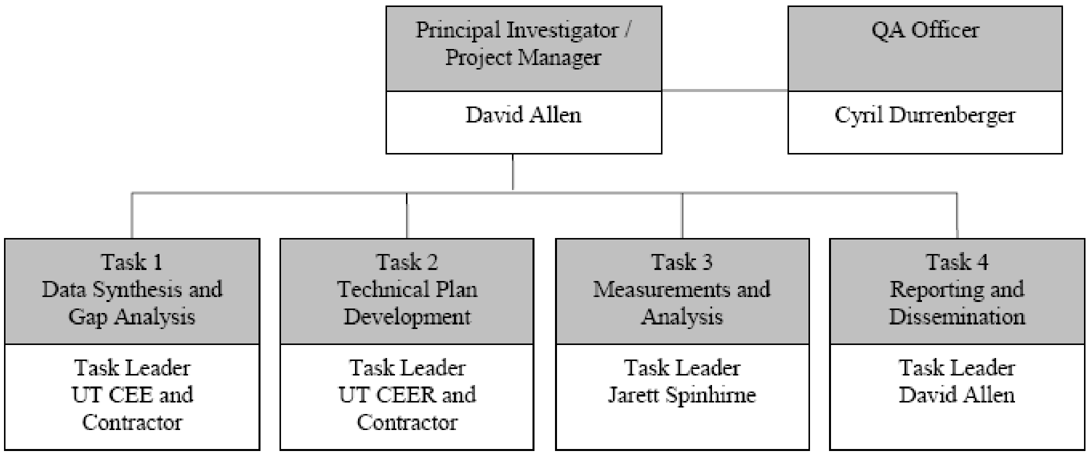
Task Timeline

Activity Timeline

3.4 Project Organization

Project Management

Figure 3-1. Organizational Structure



The organizational structure for the project is shown in Figure 3-1. **Dr. David Allen from the University of Texas will be the Principal Investigator and Project Manager**, and will be responsible for project management and the final Reporting and Dissemination conducted through Task 4. He has extensive experience in managing large air quality projects, especially those dealing with emission inventory development and performance evaluation.

Task 1 will be led by a subcontractor to be named. The subcontractor's lead investigator for this task will be qualified to efficiently review the current state of knowledge of emission factors, activity data, and knowledge gaps. They will receive assistance from staff at the Center for Energy Economics at the University of Texas, who will assist in identifying equipment characteristics associated with emissions.

Task 2 will be led a subcontractor to be named. The subcontractor will have extensive experience in developing technical work plans for air quality studies. They will receive assistance from staff at the Center for Energy Economics at the University of Texas, who will assist in collecting data on equipment counts and equipment characteristics associated with emissions.

Task 3 will be led by Jarett Spinhirne at the University of Texas. He manages the air quality measurement laboratory at the Center for Energy and Environmental Resources and has extensive and varied experience in performing laboratory and field measurements of air pollutants. He will receive assistance from a technician

Quality Assurance (QA) Activity Organization

The project Quality Assurance Officer will be Cyril Durrenberger of the University of Texas. He will have no project responsibilities other than to review the project's QA plans and to assess the extent to which the project meets its QA objectives. He is currently an employee of the University of Texas but has over 25 years of experience in air quality programs at the Texas

Commission on Environmental Quality and its predecessor agencies. The duties of the QA Officer include: ensuring that the QA procedures are implemented; reviewing the QA plan and sharing this information with the scientists on the project; serving as the focal point for addressing significant QA problems and corrective actions; understanding the sources of data and procedures used in developing the information products; auditing the research activities to ensure that errors in all phases of the development are detected and rectified as appropriate.

Data Quality Objectives and Criteria

This project involves diverse activities such as acquisition of data, transferring files, preparation into new formats, processing, and graphical and statistical analyses. As such, data quality objectives for a given work assignment will be developed as cooperative efforts between the PI and personnel responsible for the research tasks. Data quality objectives for each of the tasks will be presented in the following sections.

4. DATA SYNTHESIS AND GAP ANALYSIS

The purposes of this task are to identify, compile, and synthesize existing emission factor and activity factor data for the targeted source categories; critically review the quality and representativeness of the existing data; and recommend and prioritize emission source characteristics for new data collection efforts.

4.1 Background and Objectives

While the GRI/EPA Study serves as the basis for most CH_4 emission estimates from the natural gas industry, there have been a number of efforts to improve both the accuracy and consistency of emission factors and the activity data since the time the report was released. For example, the American Petroleum Institute (API) developed a *Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry* (referred to as the *Compendium*) which identified emission sources and assembled CH_4 emission factors for the oil and gas industry that were available at the time of the study (API, 2004). The early stages of the API Compendium development project included the review and comparison of GHG emissions estimation protocols and inventory reports available worldwide. The pilot version of the API Compendium (API, 2001) underwent industry and non-governmental organizations (NGO) review and was updated in early 2004. Part of this review process included a qualitative and quantitative benchmark of the API Compendium to the most current GHG protocols available from the oil and natural gas industry, governmental organizations, and NGOs. Differences revealed from the study formed the foundation for continued discussion with other GHG protocol and policy development groups, and the 2004 update to the API Compendium. Part of updating the API Compendium included a more detailed comparison study to identify and understand differences among various existing and newly developed emission estimation guidance documents. The project team has compiled potential updates and revisions to the API Compendium based on current GHG inventory protocols.

In addition to ongoing work with the API Compendium, outcomes from an activity conducted last year for API, the American Gas Association (AGA), the Interstate Natural Gas Association of America (INGAA), and EPA have been reviewed. This project reviewed and categorized approximately 1700 emission factors from 25 documents, which in turn referenced over 60 other publications. Emission factors for natural gas systems were compiled and compared to determine the basis for any differences, recommend preferred emission factors, and identify situations where use of alternative factors may be appropriate. Emission factors were prioritized based on uncertainty for each of the four natural gas sectors: production, processing, transmission and storage, and distribution. The key conclusion from this assessment was that the large majority of CH_4 emissions from natural gas systems are based on the seminal 1996 GRI/EPA study (GRI/EPA, 1996a) and an additional significant portion of the available information is from the 1992 Canadian Petroleum Association (CPA) study (CPA, 1992).

Our team will determine what additional information is available for the emission sources listed in Table 3-1. We will build on our understanding of a significant number of existing CH_4 emission factor studies and on findings from the 2006 report developed for the California Energy Commission (California Energy Commission, 2006) that identified gaps and recommended improvements to specific natural gas industry emission factors. We will also consider the changes in equipment and industry practices that have occurred since the earlier emission factor development work to identify emission factors that are no longer representative of an entire source category (or subgroups of particular source categories that are not represented by any emission factors).

Sources of information that our Data Synthesis and Gap Analysis will examine include the following:

- Intergovernmental Panel on Climate Change (IPCC) data system for reporting updated GHG emissions information;
- Recent studies testing fugitive emission measurement tools;
- Lessons Learned and Best Practices from EPA's GasStar;
- Measurement programs conducted in Canada and Europe;
- Information from federal agencies and industry organizations on the demographics of equipment and operating practices relevant to the emission sources of interest;
- Emerging technologies that impact emissions from the sources of interest; and
- The Gulfwide Offshore Activities Database System (GOADS) database for applicability and enhancement to emission factors for gas production and processing sources.

In addition, we will examine the potential for data available through other studies and measurement programs where the focus was not on CH_4 emissions, but where the data may support updating emissions information.

The gap analysis conducted as part of this task will examine the characteristics for each emission source that contribute to emissions and assess the availability of emissions and activity data related to these characteristics. Table 4-1 outlines potential characteristics of the emission sources or more current operating practices that may require more detailed stratification, as well as data gaps identified in the original study.

Table 4-1. Potential Characteristics and Data Gaps of Emission Sources

Industry Segment	Emissions Sources	Potential Characteristics of Interest and Data Gaps
Production	Well Clean Ups (also referred to as well tests and blowdowns)	• Large uncertainty in the original study due to limited information. • Data were correlated to gas well flow rate with simplifying assumptions. • Gas STAR Lessons Learned target actual blowdown rates.
	Completion Flaring	• Current practices include Green Completions and Reduced Emission Completions
	Well Workovers	• Original study did not attempt to stratify data by activities that result in emissions, such as drilling mud degassing.
	Pipeline Leaks	• Original study derived gathering pipeline leaks from distribution data
Processing	Recip compressors (fugitive)	• Original study did not distinguish compressor seal emissions by compressor type (reciprocating or centrifugal). • Current practices utilize dry seals in place of wet seals. • Original study did not distinguish between emissions from the seal face and emissions from seal oil degassing.
	Cent. Compressors (fugitive)	
Transmission and Storage	Pneumatic Devices (vent)	• Current practices include use of low or no-bleed pneumatics.
	Recip. Compressors (fugitive)	• Original study did not distinguish compressor seal emissions by compressor type (reciprocating or centrifugal). • Current practices utilize dry seals in place of wet seals. • Original study did not distinguish between emissions from the seal face and emissions from seal oil degassing.
	Cent. Compressor (fugitive)	
	Cent. Compress (storage)	
	Meter and Regulating Stations	• Original study stratified M&R stations by service pressure. More recent Canadian studies stratified by equipment population and defined station types.
Distribution	Residential customer meters	• Large uncertainty in the original study due to limited information.
	Mains-plastic	• Plastic pipeline outliers from the original study may be due to pre-1982 pipe. • The emission factor in the original study was based on limited data (6 measurements). More recent Canadian data are available. • Current practices utilize plastic pipe in place of cast iron for distribution mains
	Services-plastic	

4.2 Quality Objectives

The quality objectives of this task are designed to ensure that the project team develops a through understanding of the current state of emission factor uncertainties as related to the sources of interest, listed in Table 3-1. This will lead to a greater ability to focus the resources allocated to Tasks 2 and 3 on those source categories in greatest need of emission factor improvements.

4.3 Quality Assurance Activities

The uncertainty characterizations developed in this task will be reviewed by an independent stakeholder panel assembled for the project. The expert panel will be selected by and will report to the Principal Investigator and the Quality Assurance Coordinator for the project. The stakeholder panel will provide verbal and written reviews of the uncertainty characterizations.

4.4 Corrective Actions

Corrective actions may be necessary if quality assurance activities indicate errors in the uncertainty characterizations. Corrective action will be modifications to the uncertainty characterizations.

5. TECHNICAL PLAN DEVELOPMENT

The purposes of this task are to develop technical work plans and detailed cost estimates for conducting measurement studies aimed at filling the emission data gaps identified in Task 1. In doing so, we will consider the range of potential activity data metrics that could be used for developing default emission factors and gather preliminary data on relevant metrics to ensure that all the major subgroups of equipment or processes are taken into account.

5.1 Background and Objectives

Technical plans will be developed and data will be collected in two phases. Phase 1 will address sources in natural gas processing and transmission and storage. Phase 2 will address production and distribution. Within each of these two Phases, there will be technical plan development and implementation. This task describes the technical plan development process and Task 3 describes how each plan will be implemented (contingent on EPA approval).

Separate technical plans for data collection will be developed for each major segment of the natural gas industry (i.e., production, processing, transmission and storage, and distribution) and each plan will address the sources listed in Table 3-1, taking into account the findings of Task 1 (identifying the source categories in greatest need of emission factor improvements).

5.2 Quality Objectives

The quality objectives of this task are designed to ensure that the technical and sampling plans will be result in reliable data collection for updating emission factors.

5.3 Quality Assurance Activities

Since the specifics of the quality assurance activities will depend on the equipment selected for sampling, each data collection plan will have a Quality Assurance Plan update. This update will address quality objectives, experimental design, measurement methods, and data quality assessments for the specific equipment considered in the plan.

The quality objectives for each emissions source type within each industry segment will be developed in consultation with the EPA Project Officer and advice from interested stakeholders based on what are judged to be acceptable limits to the emission factor uncertainties. Once these objectives have been established, we will develop our experimental design, which will address the minimum numbers of valid measurements required and the stratifications of each emissions source types by factors such as age, size, type of service, work practice, and others on which the emission factors might depend. The variability in measurement data found in earlier studies as well as our team members' knowledge of the natural gas industry will be taken into account when stratifying source populations and determining the minimum numbers of samples needed for each source type. Practices used to reduce CH_4 emissions and accessibility of activity data needed for practical applications of the new emission factors will also be taken into account in determining the optimum source stratification.

"Volume 9: Underground Pipelines" of the 1996 GRI/EPA study on CH_4 emissions from the natural gas industry provides a good example of how sample size determination and stratification will be done. For that study, a target accuracy of ± 25% at the 90% confidence level was specified. The mean and standard deviation from available preliminary leak rate data were used to estimate the number of new leak tests required to meet the accuracy objective. Initial calculations suggested a minimum sample size of 500 leak tests for a simple random sampling scheme; however, stratification of the source population by pipe use, pipe material, and pipe age resulted in smaller variability within each stratum and a substantially reduced total measurement count requirement. Note that reducing the number of measurements needed to achieve the same quality objective increases the overall cost efficiency of the project.

For this project, an initial step will be to reassess the range of potential activity metrics that could be applied to each source category. Updated equipment counts and characterizations will help to determine whether different (updated) stratifications within any of the targeted source types are needed as a result of changes in industry practices or equipment since the earlier studies were conducted. These activity data will also be helpful later, toward building a national CH_4 emissions inventory, although the development of a national inventory is outside the scope of this project. To the extent possible, we will consider activity factors based on readily-available information tracked by the natural gas companies, trade associations, or government agencies. For example, completion flaring can be related to the number of wells completed, which is tracked by the Energy Information Agency.

A variety of standard and innovative measurement methods will be considered when choosing an approach for each source type. For example, both the EPA protocol for screening and bagging fugitive leak components and the GTI Hi-Flow™ method have been widely used in the natural gas industry for estimating emission rates from fugitive leak sources and would be likely choices for measuring emission rates from compressors. For other source types (e.g., well clean ups and workovers), other innovative approaches may be required for achieving representative measurements. In selecting a measurement approach when traditional or reference methods are unavailable, we will consider accuracy and precision of the instrumentation, cost efficiency, safety, and the ability to obtain representative and quantitative data without interfering with the host site's operations.

Each technical data collection plan will also specify how the resulting data will be validated, analyzed, and how the data quality, including uncertainty estimates, for the resulting emission factors would be assessed and reconciled with the user requirements.

Finally, each data collection plan will include a cost estimate for implementation, which will be broken down by source type within each industry segment. It is possible, perhaps probable, that budgetary constraints will prohibit collecting the number of measurements needed to achieve the quality goals for every source type. If that is the case, the implementation cost estimates we develop for each technical plan will help prioritize the data collection activities.

In summary, we will prepare separate data collection plans for each segment of the natural gas industry, which will each address the priority emission sources listed in Table 3-1 for a given industry segment. Segmenting the preparation of the plans in this manner will provide for cost effective drafting of the documents and efficient EPA/stakeholder review. Each plan will address the quality objectives, experimental design, measurement methods, and reconciliation of the collected data with the user requirements.

Review of the technical plans will be an important component of this task. Experience has demonstrated that consultation and sharing of information between partners, groups, and individuals, helps to enhance the quality of operations, and is essential for the adequate development and implementation of this project, including gaining access to host sites for measurements. Thus, technical plan reviews will be conducted after the project team develops the initial drafts. The purpose of meetings and conference calls conducted during these technical plan reviews will be to:

- Provide a feedback mechanism and input of information from participants on interim development before finalizing technical plans; and
- Gather input and available information to support our review of emission factor data, emission source characterization, and activity factor data.

We will structure these activities in coordination with EPA and the industry stakeholders. After comments obtained through the stakeholder meetings are addressed, and QAPPs are approved by the EPA, data collection will begin for Phase 1, and technical plan/QAPP development will begin for Phase 2.

Sources to be considered in Phase 1 are:

- Fugitive emissions from reciprocating compressors in processing operations;
- Fugitive emissions from centrifugal compressors in processing operations;
- Fugitive emissions from reciprocating compressors in transmission and storage operations;
- Vent emissions from pneumatic devices;
- Fugitive emissions from centrifugal compressors in transmission and storage operations; and
- Emissions from centrifugal compressors in storage applications.

Sources to be considered in Phase 2 are:

- Well clean-ups in production operations;
- Completion flaring in production operations;
- Well workovers in production operations;
- Pipeline leaks in production operations;
- Meter and regulating stations in distribution operations;
- Residential customer meters in distribution operations;
- Plastic mains; and
- Plastic service connections in distribution operations.

5.4 Corrective Actions

Corrective actions may be necessary if the stakeholder panels indicate that the sampling plans require modification. All modifications will be approved by the project's Quality Assurance Officer and the EPA Project Officer.

6. MEASUREMENTS AND ANALYSIS

The purposes of this task are to execute the technical plans developed in Task 2, contingent on authorization by EPA; and analyze the resulting data to develop new default emission factors and uncertainty estimates for the measured sources.

6.1 Background and Objectives

Until the emission factor gap analysis and detailed technical plans of Tasks 1 and 2, respectively, have been completed, it is uncertain what measurements, pertaining to which source categories, would be most cost effective toward improving the industry's CH_4 emissions inventory estimates. Therefore, measurements made for a particular source category under this task would be contingent on EPA's authorization to proceed and constrained by the overall budget allocated to this task. We anticipate that data collection for natural gas processing and for transmission and storage will take place during mid-2008, while data collection for production and distribution will take place during mid-2009.

6.2 Quality Objectives

The quality objectives of this task are designed to ensure reliable data for updating emission factors.

6.3 Quality Assurance Activities

Emission rate measurements for Phase 1 sources will be made using traditional methods that have had widespread use in the natural gas industry. Emissions from fugitive leak sources (e.g., compressors) will be measured using either the EPA protocol for screening and bagging fugitive components or the GTI Hi-Flow sampler approach. In the EPA method, fugitive leak components are isolated from the environment by enclosing them in sealed bags or tents. Carrier gas (e.g., zero-air or nitrogen) is then blown or drawn through the enclosures at controlled rates and the CH_4 in the carrier gas exiting the enclosures is measured. Emission rates are calculated from the carrier gas flow rates and CH_4 concentrations. In the GTI approach, a large volume of air is drawn from around the leaking component – sufficient to capture the entire leak – into a sampling line. Mass flow rate in the sampled air is determined using a thermal anemometer and the concentration of CH_4 or other hydrocarbons in the sample is determined by a dual detection system (catalytic-oxidation/thermal-conductivity) that allows concentrations to be measured over the range of 0.01 to 100 percent. The instrument operator controls sampling rate so that the concentration of CH_4 in the sampled air is as high as possible, yet less than 100%, to ensure that the entire leak is captured. As in bagging studies, the leak rate is determined by the product of the flow rate and the CH_4 concentration.

The emission rates from vented sources will be measured using appropriate flow-through measurement devices, such as a precision rotary meter, diaphragm flow meter, or rotameter, or by measuring the velocity profile and flow area across the vent line.

The emission (field) data will be collected by a team consisting of a technician experienced in emission factor collection, and an analytical chemist from the University of Texas. Once the data are collected, staff at the University of Texas will process the data to determine emission rates. Data obtained from Task 3 will necessarily be collected from a limited number of sources, as measuring all emission sources is prohibitively expensive and time consuming. Therefore, a key component of Task 3 is the statistical analysis of the data to ensure that uncertainties are reduced for the emission sources of interest.

Standard Operating Procedures (SOP) will be developed for each technical plan developed in the project. The SOPs developed will be followed for routine collection of data to prevent any introduction of uncertainty into the resulting measurements because of deviation from the SOP. Non-routine procedures will be covered by an accompanying research protocol (RP). Both the SOP and RP will contain concise and clear descriptions of the measurement activities.

The SOPs and RPs will be included in the technical plans. Overall, these documents will describe the planning, implementation, and assessment of the quality assurance of the measurement project. The documents will also include a description of the systems maintenance, operator training requirements, data and records management plans, quality assurance procedures, and routine controls to be performed.

The project's QA Officer will review plans before sampling begins and will perform audits after data are collected.

6.4 Corrective Actions

Corrective actions may be necessary if the sampling plans or data analysis methods require modification. All modifications will be approved by the project's Quality Assurance Officer and the EPA Project Officer.

7. REPORTING AND DISSEMINATION

Reporting and communication with stakeholders will be integrated into all of the tasks and a final reporting task will disseminate project results

7.1 Background and Objectives

Tasks 1, 2 and 3 will each have outputs that include Reporting and Dissemination. An output of Task 1 will be a report describing the Data Synthesis and Gap Analysis. An output of Task 2 will be reports describing sampling protocols and QAPPs. An additional output of Task 2 will be two stakeholder meetings (one before Phase 1 data collection and one before Phase 2 data collection) that involve reporting, review and dissemination of draft protocols and QAPPs. The outputs of Task 3 will be reports describing emission factors.

Once the Reporting and Dissemination through Tasks 1-3 is completed, an additional level of reporting and dissemination to stakeholders will be initiated (Task 4).

7.2 Quality Objectives

The quality objectives of this task are designed to ensure that the project reports and summaries accurately reflect the supporting analyses.

7.3 Quality Assurance Activities

All of the communication materials will be reviewed by the study's stakeholder panel and the EPA Project Officer prior to release.

7.4 Corrective Actions

The Quality Assurance Officer and the Principal Investigator will respond to review comments and these responses will be documented.

8. SCHEDULE AND DELIVERABLES

A summary of the Project Outcomes is provided in Table 8-1.

Table 8-1. Project Outcomes and Schedule

Tasks	Outcomes	Due date
Task 1: Data Synthesis and Gap Analysis	• Improved understanding of the current state of emission factor development as related to the sources. • A greater ability to focus the resources allocated to Tasks 2 and 3 on those source categories in greatest need of emission factor improvements.	Mid-2008
Task 2: Technical Plan Development	• Development of a set of stakeholder reviewed, EPA-approved technical plans and detailed cost estimates to acquire new CH_4 emission rate data needed to fill data gaps identified in Task 1.	Early 2009 (Phase 1) Early 2010 (Phase 2)
Task 3: Measurements and Analysis	• Improved CH_4 emission factors.	Early 2011
Task 4: Reporting and Dissemination	• Improved CH_4 emission factors and activity data for the natural gas industry, described in final versions of reports; dissemination will be through presentations at conferences and meetings	Mid-2011

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