

**GHG Emission Factor Development Project for Selected
Sources in the Natural Gas Industry**

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Project Overview

Methane (CH₄) is the primary component of natural gas and is also a potent greenhouse gas (GHG). Emissions of CH₄ 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 CO₂ equivalent basis. The overall goal of the project is to update default CH₄ emission factors for selected processes and equipment used in the natural gas industry. The default emission factors will be updated by compiling and synthesizing existing data for a variety of source categories 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.

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 CH₄ emission factor and activity factor data; (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.

Progress on Tasks

Quality Assurance Project Plan

Before any work was initiated on any of the tasks, a quality assurance project plan (QAPP) was written and approved.

Identify subcontractor and establish sub-contract

As described in the QAPP, a number of tasks are to be performed by a sub-contractor with extensive expertise in developing emission factors for the natural gas industry. A sole-source subcontract was approved for URS Corporation, and a subcontract was established.

Task 1

A comprehensive list was compiled of sources of emission factor and/or activity factor data that may have relevance to the natural gas sources of interest (shown below). Many of these references were identified in URS's recent update to the American Petroleum Institute's (API)

Compendium on greenhouse gas emission factors or are sources that URS is familiar with through other projects.

Potential Data References

- American Gas Association. Gas Facts, 2007, A Statistical Record of the Gas Industry, 2006 Data. 01 March 2008.
- American Gas Association. Greenhouse Gas Emission Estimation Methodologies, Procedures, and Guidelines for the Natural Gas Distribution Sector, Draft, Prepared by innovative environmental solutions, inc., April 4, 2008.
- American Petroleum Institute. *Fugitive Hydrocarbon Emissions for Oil and Gas Production Operations*, API Publication Number 4589, Prepared by Star Environmental. December 1993.
- Australian Government Department of Climate Change. Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006 Energy (Fugitive Fuel Emissions), National Greenhouse Gas Inventory Committee, Australia, December 2007.
<http://www.greenhouse.gov.au/inventory/methodology/index.html>
- Australian Government Department of Climate Change. Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006 Energy (Stationary Sources), National Greenhouse Gas Inventory Committee, December 2007.
<http://www.greenhouse.gov.au/inventory/methodology/index.html>
- Australian Government Department of Climate Change. National Greenhouse Accounts (NGA) Factors, Canberra ACT, January 2008.
- <http://www.greenhouse.gov.au/workbook/pubs/workbook-feb2008.pdf>
- California Air Resources Board. Documentation of California's Greenhouse Gas Inventory (website), April 10, 2008, http://www.arb.ca.gov/cc/inventory/doc/doc_index.php
- California Climate Action Registry. Natural Gas Transmission and Distribution Greenhouse Gas Reporting Protocol, Draft, February 2008.
- California Energy Commission, Evaluation of Oil and Gas Sector Greenhouse Gas Emissions Estimation and Reporting, Final Draft Report FR-05-100, April 2006.
- California Energy Commission, *Research Roadmap for Greenhouse Gas Inventory Methods*, Prepared by University of California, Berkeley, Lawrence Berkeley National Laboratory, California Energy Commission, Consultant Report CEC-500-2005-097, July 2005.
http://www.energy.ca.gov/pier/final_project_reports/CEC-500-2005-097.html
- Canadian Association of Petroleum Producers. *A National Inventory of Greenhouse Gas (GHG), Criteria Air Contaminant (CAC) and Hydrogen Sulphide (H2S) Emissions by the Upstream Oil and Gas Industry, Vols. 1-5*, Prepared by Clearstone Engineering Ltd., Calgary, Alberta, Canada, September 2004.
http://www.capp.ca/default.asp?V_DOC_ID=763&SubjectID=414802
- Delucchi, Mark A. A Lifecycle Emissions Model (LEM): Lifecycle Emissions from Transportation Fuels, Motor Vehicles, Transportation Modes, Electricity Use, Heating and Cooking Fuels, and Materials, Appendix E: Methane Emissions from Natural Gas Production, Oil Production, Coal Mining and Other Sources, Institute of Transportation Studies, University of California Davis, UCD-ITS-RR-03-17E, December 2003.
http://pubs.its.ucdavis.edu/author_detail.php?id=5
- Environment Canada Greenhouse Gas Division. National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990-2005, April 2007.

- http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/tdm-toc_eng.cfm
- European Environment Agency. Annual European Community Greenhouse Gas Inventory 1990-2005 and Inventory Report 2007, Technical Report No 7/2007, 27 May 2007. http://reports.eea.europa.eu/technical_report_2007_7/en
- Fernandez, Roger, Robin Petrusak, Donald Robinson, and Duane Zavadil. Cost Effective Methane Emission Reductions for Small and Midsize Natural Gas Producers, Journal of Petroleum Technology, June 2005. http://www.icfi.com/Markets/Environment/doc_files/methane-emissions.pdf
- Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 4: Fugitive Emissions*, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds), IGES, Japan, 2006. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_4_Ch4_Fugitive_Emissions.pdf
- Intergovernmental Panel on Climate Change, National Greenhouse Gas Inventories Programme. IPCC Emission Factor Database (EFDB) (website), April 10, 2008. http://www.ipcc-nggip.iges.or.jp/EFDB/find_ef_main.php
- International Association of Oil and Gas Producers. *Environmental Performance in the E&P Industry 2006 Data*, Report No. 399, October 2007. <http://www.ogp.org.uk/pubs/399.pdf>
- International Association of Oil and Gas Producers. Flaring & Venting in the Oil & Gas Exploration & Production Industry: An Overview of Purpose, Quantities, Issues, Practices and Trends, Report No. 2.79/288, January 2000. <http://www.ogp.org.uk/pubs/288.pdf>
- -International Petroleum Industry Environmental Conservation Association, International Association of Oil and Gas Producers and American Petroleum Institute. *Petroleum Industry Guidelines for Reporting Greenhouse Gas Emissions*, Prepared by Battelle, December 2003. http://www.ipieca.org/activities/climate_change/downloads/publications/ghg_guidelines.pdf
- Interstate Natural Gas Association of America. *Activities to Reduce Greenhouse Gas Emissions from Natural Gas*, Prepared by Energy Resources International Inc., Publication F-2000-05, Washington, D.C. 20036, 2000. <http://www.ingaa.org/cms/31/3243/3247/3229/277.aspx>
- Interstate Natural Gas Association of America. Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage, Volume 1: GHG Emission Estimation Methodologies and Procedures, Prepared by Innovative Environmental Solutions, Inc., Washington, D.C. 20002, Revision 2, September 28, 2005.
- Interstate Natural Gas Association of America, American Petroleum Institute, and American Gas Association. INGAA/API/AGA Natural Gas Systems GHG Emission Factor Comparison & Improvement Collaborative Project – Status Report: Task 2 - Emission Factor Comparison, Draft Technical Report, 27 November 2005.
- Methane to Markets. Methane to Markets Documents, Tools and Resources, April 10, 2008. <http://www.methanetomarkets.org/index.htm>
- Robinson, D.R., R. Fernandez, and R.K. Kantamaneni. *Methane Emissions Mitigation Options in the Global Oil and Natural Gas Industries*. <http://www.epa.gov/gasstar/pdf/ng020.pdf>
- United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution Co-operative Programme for Monitoring and Evaluation of the Long-range transmission of Air Pollutants in Europe. *EMEP/CORINAIR Emission Inventory*

Guidebook - 2007, Technical Report No 16/2007, December 2007.

<http://reports.eea.europa.eu/EMEP/CORINAIR5/en/page002.html>

- U.S. Department of Energy, Energy Information Administration Office of Integrated Analysis and Forecasting. *Documentation for Emissions of Greenhouse Gases in the United States 2005*, DOE/EIA-0638 (2005), Washington, D.C. 20585, October 2007.
- U.S. Department of Energy, Energy Information Administration. *Monthly Energy Review*, Washington, D.C., various years. http://www.eia.doe.gov/overview_hd.html
- -U.S. Department of Energy, Energy Information Administration. *Natural Gas Annual*, Washington, D.C., various years. http://tonto.eia.doe.gov/dnav/ng/ng_pub_publist.asp
- U.S. Department of Energy, Energy Information Administration. *Natural Gas Monthly*, Washington, D.C., various years. http://tonto.eia.doe.gov/dnav/ng/ng_pub_publist.asp
- U.S. Department of Energy, Energy Information Administration Office of Policy and International Affairs. *Technical Guidelines Voluntary Reporting of Greenhouse Gases (1605(b)) Program, Office of Policy and Internal Affairs, United States Department of Energy*, January 2007.
http://www.pi.energy.gov/enhancingGHGregistry/documents/January2007_1605bTechnicalGuidelines.pdf
- U.S. Department of the Interior, Minerals Management Service Gulf of Mexico OCS Region. *Year 2005 Gulfwide Emission Inventory Study*, OCS Study MMS 2007-067, Prepared by Eastern Research Group, Inc., New Orleans, December 2007.
<http://www.gomr.mms.gov/PI/PDFImages/ESPIS/4/4276.pdf>
- U.S. Department of Transportation, Office of Pipeline Safety. *Pipeline Statistics*, April 15, 2008. <http://ops.dot.gov/stats/stats.htm>
- U.S. Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2005*, Washington, D.C. 20460, April 15, 2007.
<http://www.epa.gov/climatechange/emissions/downloads06/07CR.pdf>
- U.S. Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2006*, Public Review Draft, Washington, D.C. 20460, February 22, 2008.
<http://www.epa.gov/climatechange/emissions/usinventoryreport.html>
- U.S. Environmental Protection Agency. *Natural Gas STAR Documents, Tools and Resources*. <http://www.epa.gov/gasstar/>

In addition to compiling potential source materials, analysis of recent methodological reviews for developing emission factors is now underway. In 2000, API initiated a project to develop an industry-wide protocol for quantifying GHG emissions based on a compilation of recognized emission factors and emission estimation techniques applicable to world-wide oil and natural gas industry operations. The early stages of the API Compendium¹ development project included the review and comparison of the following GHG emissions estimation protocols and inventory reports:

1. American Petroleum Institute (API). *Methane and Carbon Dioxide Emission Estimates from U.S. Petroleum Sources*, January 1997.

¹ American Petroleum Institute. *Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry*, API, Washington, DC, 2004. Errata, February, 2005. http://www.api.org/ehs/climate/new/upload/2004_COMPENDIUM.pdf
<http://ghg.api.org/documents/CompendiumErrata205.pdf>

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, Volumes 1-15, 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.

On completion, the pilot API Compendium underwent review with other GHG protocol and policy development groups. In updating the API Compendium, a more detailed comparison study was conducted to identify and understand differences among various existing and newly developed emission estimation guidance documents. The following documents underwent industry and NGO review. Part of this review process included a qualitative and quantitative benchmark of the Compendium to the most current GHG protocols available from the oil and gas industry, governmental, and non-governmental organizations. Differences revealed from the study formed the foundation for continued discussion reviewed on a qualitative basis to examine differences between their emission estimation approaches and those provided in the API Compendium.

- Australian Greenhouse Office (AGO), Workbook for Fuel Combustion Activities (AGO a, 1999) and Workbook for Fugitive Fuel Emissions (Fuel Production, Transmission, Storage, and Distribution) (AGO b, 1999);
- Australian Petroleum Production and Exploration Association (APPEA), Greenhouse Challenge Report (APPEA, 2000);
- Canadian Association of Petroleum Producers (CAPP), Calculating Greenhouse Gas Emissions (CAPP a, 2003);
- Canadian Association of Petroleum Producers (CAPP), Estimation of Flaring and Venting Volumes from Upstream Oil and Gas Facilities (CAPP b, 2003);
- Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) memorandum on “Guide for the Consumption of Energy Survey” (CIEEDAC, 2000);
- Environmental Protection Agency (EPA), Emission Inventory Improvement Program (EIIP, 1999);

- European Environment Agency (EEA), EMEP/CORINAIR Emission Inventory Guidebook (EEA, 2002);
- Exploration and Production Forum (E&P Forum) Methods for Estimating Atmospheric Emissions from E&P Operations (E&P Forum, 1994);
- Intergovernmental Panel on Climate Change (IPCC), Guidelines for National Greenhouse Gas Inventories (IPCC, 1997; UNECE/EMEP, 1999; IPCC, 2001);
- Regional Association of Oil and Natural Gas Companies in Latin America and the Caribbean (ARPEL), Atmospheric Emissions Inventories Methodologies in the Petroleum Industry (ARPEL, 1998);
- UK Emissions Trading Scheme (DEFRA, 2003);
- UK Offshore Operators Association Limited, Guidelines for the Compilation of an Atmospheric Emissions Inventory (UKOOA, 2002); and
- World Resources Institute and World Business Council for Sustainable Development, The Greenhouse Gas Protocol (WRI/WBCSD, 2001) and calculation tools for Stationary and Mobile Combustion Sources (WRI/WBCSD, 2003).

Similarly, the INGAA GHG Emissions Estimation Guidelines for Natural Gas Transmission and Storage Document (referred to as the INGAA Guidelines)² presents a compilation of estimation methods for assessing GHG emissions from combustion and non-combustion sources at natural gas transmission and storage facilities. Additional resources reviewed in developing the INGAA Guidelines include the following:

- GRI Canada. Handbook for Estimating Methane Emissions From Canadian Natural Gas Systems. Prepared by Clearstone Engineering Ltd., Enerco Engineering Ltd., and Radian International for Gas Technology Canada. Guelph, ON, 1998
- GHGCalc™, Gas Research Institute software Version 1.0, GRI-99/0086 December 1999 and GRI-GHGCalc™, Version 1.0 Emission Factor Documentation, July 2001
- AEA Technology Environment, R Stewart, A Survey of Gaseous Emissions to Atmosphere from UK Gas Turbines (1998)
- AEUB, Alberta Energy and Utilities Board, “*Guide 60: Upstream Petroleum Industry Flaring Guide*” (February 2001)
- AGO – 2004 - "Australian Methodology for the Estimation of Greenhouse Gas Emissions and Sinks (2002), Energy (Stationary Sources)" National Greenhouse Gas Inventory Committee, Australian Greenhouse Office (May 2004).
- CORINAIR 94 (Core Inventory Air), European Topic Centre on Air Emissions, CORINAIR 1994 Inventory, European Environment Agency (1998)
- CORINAIR 90, European Topic Centre on Air Emissions, CORINAIR 90 Summary Report.
- Edison Mission Energy “Greenhouse Gas Emission Factor Review - Final Technical Memorandum” (February, 2003)
- Environment Canada, *Canada's Greenhouse Gas Inventory 1990-2001*, Greenhouse Gas Division (August 2003)

² Interstate Natural Gas Association of America (INGAA). *Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage, Volume 1 – GHG Emissions Estimation Methodologies and Procedures*, Revision 2, Interstate Natural Gas Association of America, E-2005-01, September 28, 2005. <http://www.ingaa.org/environment/Climate.htm>

- European Environment Agency “Annual European Community Greenhouse Gas Inventory 1990 – 2002 and Inventory Report 2004” (July 2004)
- International Association of Oil & Gas Producers “Environmental Performance in the Exploration and Production Industry, 2003 Data” (December 2004)
- Interstate Natural Gas Association of America (INGAA) White Paper “Greenhouse Gas Emissions Inventory for Natural Gas Transmission and Storage: Status of Emission Estimation Methods and Issues for Development of a Sector-Specific Report” (September 2004)
- IPCC Emission Factor Database (EFDB) – National Greenhouse Gas Inventories, website (3/31/05); http://www.ipcc-nggip.iges.or.jp/EFDB/find_ef_main.php
- United States Department of Energy (US DOE) Office of Policy and International Affairs “*Draft Technical Guidelines Voluntary Reporting of Greenhouse Gases (1065b) Program*,” Office of Policy and Internal Affairs United States Department of Energy” (March 2005)
- US DOE Energy Information Administration (EIA) Office of Integrated Analysis and Forecasting “Documentation for Emissions of Greenhouse Gases in the United States 2002” (January 2004)
- US DOE EIA. Emissions of Greenhouse Gases in the United States 2001, DOE/EIA-0573(2001) (December 2002)
- US DOE EIA Office of Integrated Analysis and Forecasting “*Emissions of Greenhouse Gases in the United States 2003*” (December 2004)
- US DOE “*Guidelines for Voluntary Greenhouse Gas Reporting*” 10 CFR part 300, RIN 1901-AB11 (March 2005)
- United States Environmental Protection Agency (US EPA), Office of Air Quality Planning and Standards; “AP 42, Fifth Edition: *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*” (January 1995); Supplement A, B, and C, (October 1996); Supplement D (July 1998) Supplement E, 1999; and Supplement F, April 2000.
- US EPA “US Emissions Inventory 2004 Inventory of US Greenhouse Emission and Sinks: 1990-2002” (April 2004)
- US EPA “Quality Assurance/Quality Control and Uncertainty Management Plan for the U.S. Greenhouse Gas Inventory: Procedures Manual for Quality Assurance/Quality Control and Uncertainty Analysis” EPA 430-R-02-007B (June 2002)
- US EPA, US Emissions Inventory 2005: Inventory of US Greenhouse Gas Emissions and Sinks: 1990 - 2003, EPA 430-R-003, US Environmental Protection Agency, Washington, D.C., (April 2005)
- U.S. EPA Office of Atmospheric Programs, “*Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000*”, EPA 460-R-02-003, Washington, DC, April 15, 2002.
- US EPA “Draft Inventory of US Greenhouse Gas Emissions and Sinks: 1990 – 2003” (February 2004)
- US EPA, 1995 “*Protocol for Equipment Leak Emission Estimates*”, EPA-453/R-95-017, November 1995
- US EPA “Quality Assurance/Quality Control and Uncertainty Management Plan for the U.S. Greenhouse Gas Inventory: Background on the U.S. Greenhouse Gas Inventory Process” EPA 430-R-02-007A (June 2002)

- Co-operative Programme for Monitoring and Evaluation of the Long Range transmission of Air Pollutants in Europe/The Core Inventory of Air Emissions in Europe (EMEP/CORINAIR) “Atmospheric *Emission Inventory Guidebook, 3rd Edition, September 2003 Update*” (October 2003).
- De Soete G.G., “*Nitrous Oxide from Combustion and Industry*”, Proceedings of International IPCC Workshop Methane and Nitrous Oxide, pp 287-358, 1993
- De Soete, G. G. and B. Sharp, “Nitrous Oxide Emissions: Modifications as a Consequence of Current Trends in Industrial Fossil Fuel Combustion and In Land Use”, EUR-13473, 1991.
- Ritter, K.; Lev-On, M; Shires, T. “*Development of a Consistent Methodology for Estimating Greenhouse Gas Emissions from Oil and Gas Industry Operations*”, Presented at the 11th Emissions Inventory Conference of the U.S. Environmental Protection Agency, Atlanta, GA, April 2002.
- Ryan, J. V., and W.P. Linak, “On-line Measurement of Nitrous Oxide from Combustion Sources by Automated Gas Chromatography”, EPA/600/A-92/215, NTIS PB 93106847, 1993
- Draft Memorandum from URS to GTI, “Nitrous Oxide Emissions from Natural Gas-Fired Reciprocating Internal Combustion Engines”, January 2002

A key conclusion from the review of existing data sources is that the majority of vented and fugitive emission factors associated with natural gas industry operations are based on work conducted by the Gas Research Institute (GRI) and Environmental Protection Agency (EPA).³

³ Gas Research Institute (GRI) and EPA. *Methane Emissions from the Natural Gas Industry*, June 1996.

Plans for Next Quarter

Task 1

During the next quarter we plan to reach out to U.S. and Canadian natural gas industry trade associations to review our list of references and seek input regarding other recent emission factor data that might not be in the public domain. Of particular interest, AGA is finalizing a guidelines document on GHG emission estimation methodologies for the natural gas distribution sector. Part of this document summarizes information gathered at AGA member facilities during field work conducted in the fall of 2007. We believe that similar GHG measurements have been conducted on natural gas systems in Canada. We hope that participation of the industry associations will allow data from these measurement programs to be shared with EPA for the purpose of this study

As part of a separate project, URS is conducting a natural gas industry survey on behalf of the Canadian Energy Partnership for Environmental Innovation (CEPEI). The primary purpose of the survey is to determine best practices in reducing methane emissions to control greenhouse gas (GHG) emissions. Survey responses are expected to be compiled this summer. Findings from this survey may also reveal additional data sources.

During the next quarter we also plan to review the data sources listed in this report, and any additional data that becomes available, for information that might augment emission factors that are currently in widespread use for the source types of interest. We will identify limitations of the conventional emission factors and determine whether any of the more recent data addresses those limitations. A draft report of our findings in Task 1, conclusions, and recommendations for additional data gathering will be produced.

Task 2

During the next quarter we will prepare a draft work plan specifying methods and procedures for gathering additional data needed for updating factors used for estimating methane emissions from centrifugal and reciprocating compressors used in natural gas processing. The draft work plan will focus on the types of data needed to address limitations or weaknesses of existing factors as identified in Task 1. After obtaining EPA and industry review of the draft natural gas processing work plan, and addressing comments, the work plan will be completed and used as a model for a similar document which will address compressors, pneumatic devices, and meter/regulating stations used in natural gas transmission and storage.

Fund Expenditures

The primary accomplishments during this quarter (preparation of the QAPP, establishing the contract with URS) were accomplished without direct charged staff time. David Allen, who prepared the QAPP, has his academic year salary paid by the University of Texas and sub-contracting tasks are covered by the indirect costs charged to the project through the University of Texas. With the sub-contract now in place, task related salary charges will begin to appear for Tasks 1 and 2 beginning in April 2008.

Equipment Purchased

None