STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Vermont Gas Systems, Inc., requesting a Certificate of Public Good pursuant to 30 V.S.A. § 248, authorizing the construction of the **"Addison Natural Gas Project"** consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainline in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont	)))))))))))	Docket No. 7970

<u>REBUTTAL TESTIMONY OF JEFF MERRELL</u>

On Behalf of the Vermont Agency of Natural Resources,

Department of Environmental Conservation,

Air Quality and Climate Division

Summary of Testimony

Mr. Merrell is an Environmental Analyst with the Air Quality and Climate Division. He provides a review of the testimony of Mr. Bluestein and associated exhibits regarding the potential greenhouse gas emissions benefits of the project.

Q1. Please state your name, place of employment and your position.

A1. My name is Jeff Merrell. I am an Environmental Analyst with the Air Quality and Climate Division (AQCD) of the Department of Environmental Conservation within the Agency of Natural Resources.

Q2. Are you the same Jeff Merrell who prepared direct testimony on behalf of the Agency of Natural Resources in this docket?

A2. Yes.

Q3. What is the purpose of your testimony?

A3. To respond to the analyses performed by Mr. Bluestein for Vermont Gas and Dr. Stanton for CLF.

Q4. In your direct testimony, you identified the need for a life-cycle analysis? Since you filed your direct testimony in this matter, has Vermont Gas (or any party) responded to your request to provide a life-cycle analysis?

A4. Yes, Vermont Gas Systems' consultant (ICF) has provided a life-cycle analysis comparing greenhouse gas (GHG) emissions from fuel oil and natural gas.

Q5. Have you evaluated the ICF report? Do you have an opinion regarding the methodology of the report?

A5. Yes, I have read the testimony and analyses prepared by Mr. Bluestein of ICF for Vermont Gas. The ICF analysis examines the full fuel life-cycle GHG emissions associated with all stages from extraction through distribution of natural gas to Vermont Gas customers. The analysis also provides an estimate of life-cycle GHG emissions from heating oil, and 7% biofuel delivered to Vermont customers, as well as on a "delivered heat energy basis" which considers heating unit / boiler efficiency. A comparison of these life-cycle GHG emissions estimates from natural gas vs. heating oil vs. 7% biofuel suggests that natural gas has the lowest life-cycle GHG emissions of the fuels compared. The methodology presented by Mr. Bluestein takes into account most of the upstream life-cycle GHG emissions associated with natural gas and fuel oil.

The ICF analysis was not exhaustively comprehensive in that it did not provide comparable life-cycle emissions analysis for propane, the other major fuel in the region identified by Vermont Gas in exhibit EMS-1. The GHG emissions results are also reported as single values. A number of the assumptions (for both fuel oil and natural gas) underlying the analysis were derived from datasets with fairly wide variability and uncertainty. As a result, it would've been more informative, and more reflective of the data variability, if the analysis showed an expected range of results.

Q6. **You mentioned that the ICF analysis takes into account most of the upstream life-cycle GHG emissions, what emissions were not included?**

A6. Mr. Bluestein indicates on page 10 of the report that the ICF analysis does not take into account GHG emissions associated with changes in land-use for biofuels.

Q7. Do you have any questions or issues regarding some of the information or assumptions used in the ICF analysis?

A7. Yes, the assumptions used to determine upstream emissions from natural gas rely upon published assumptions about upstream life-cycle methane emission rates rather than actual site-specific data from the components of the natural gas supply chain that Vermont Gas will be using. While it is true that the US EPA recently has adjusted its estimate of GHG emissions from natural gas systems downward, and this is reflected in the ICF numbers (i.e., a leakage rate of 1.6% of the methane in U.S. gross withdrawals from natural gas wells in 2011); there is at least one recent study that directly quantified much higher GHG emissions from natural gas extraction, with a methane leakage rate on the order of 6-12% of total production (See: http://cires.colorado.edu/news/press/2013/methaneleaks.html). A single study that directly measured a high leakage rate does not prove that all such operations have high leakage rates, but it does demonstrate that high leakage rates can occur at specific locations. As a result, it highlights the need to continue to collect and utilize data that more accurately reflect leakage rates and other attributes of a specific natural gas supply chain (i.e., extraction, production, transmission, distribution, consumption, etc.).

If any of the specific sources providing Vermont Gas with natural gas have similarly high fugitive emissions, then the life-cycle GHG benefits of the Vermont Gas project could be reduced or even result in a scenario of increased GHG emissions relative to oil. Given the variability in the literature results and apparent variability of fugitive emissions from different natural gas operations, it is important to continue to collect more project-relevant data to better understand the actual life-cycle GHG emissions characteristics.

Q8. CLF has offered the testimony of Dr. Stanton. Has Dr. Stanton prepared a life-cycle analysis?

A8. Dr. Stanton's analysis is an expanded, more comprehensive analysis of the scenario presented by Eileen Simollardes in exhibit EMS-1. However, Dr. Stanton's analysis is not a life-cycle analysis as it does not provide a comprehensive comparison of both "upstream" and "burner tip" emissions from natural gas, oil and propane.

Q9. Both Dr. Stanton and Mr. Bluestein discuss methane densities and each has selected a different methane density for their respective analysis? Could you explain what is meant by methane density and what role does the methane density serve in the analysis?

A9. Methane density refers to the mass, or amount of matter, contained in a known volume of the gas. Methane is highly compressible, and a greater number of methane molecules can be "packed" into a given volume when it is pressurized. So, for example, a cubic foot of methane at normal atmospheric pressure and temperature would contain fewer molecules and thus have a lower density than a cubic foot of methane that has been pressurized in a pipeline at the same temperature. Greenhouse gas (GHG) emissions are calculated in units of mass (e.g., lbs, metric tons, etc.), and methane releases from natural gas systems are measured in units of volume (cubic feet, cubic meters, etc.). Converting from volume of methane (e.g., cubic feet) to mass (e.g., lbs) requires knowing the density of the methane (e.g., lbs per cubic foot). Using a lower density value for methane results in a lower estimate of GHG emissions.

Q10. Of the methane densities selected by Dr. Stanton and Mr. Bluestein which one appears to be technically valid and why?

A10. Depending on the specific temperature and pressure conditions, methane can exhibit the densities identified by both Dr. Stanton and Mr. Bluestein. However, so long as an analysis accounts for the actual pressure and temperature at the point of release for all volumetric releases of methane, and these have been converted properly to values at standard temperature and pressure, then the density of methane at standard temperature and pressure can be applied to all methane releases as presented by Mr. Bluestein. It is my understanding that the methane emission factors from the US EPA and the NETL study used by ICF have taken this conversion into account.

Q11. Of the two analyses provided by Dr. Stanton and Mr. Bluestein which one provides the more reliable information on the potential change in GHG emissions from the project and why?

A11. Notwithstanding the caveats and concerns I raised earlier regarding Mr. Bluestein's analysis, his analysis provides a more valid assessment of the potential change in GHG emissions from the project. This is primarily due to two factors. First, the analysis by Mr. Bluestein provides a more "apples to apples" comparison of natural gas and fuel oil (but unfortunately not propane) life-cycle GHG emissions. As stated earlier, the analysis provided by Dr. Stanton is not a life-cycle analysis. Second, Mr. Bluestein's analysis uses a value for the density of methane that appears to be consistent with standard GHG emissions inventory accounting practices.

Q12. Do you have any other recommendations for the Board or VG?

A12. We applaud the fact that Vermont Gas has provided a life-cycle analysis that more comprehensively assesses the relative GHG emissions that can be expected from the Addison expansion project. If this project is constructed, to ensure that it achieves the potential GHG benefits Vermont Gas claims it will provide, it will be necessary to verify the actual GHG emissions from both the transmission and distribution equipment operated by Vermont Gas, and the upstream life-cycle GHG emissions from transmission, production, extraction, workovers, etc. The life-cycle emissions of this project could change appreciably if, in the future, the natural gas supplied to Vermont Gas has higher (or lower) associated methane emissions rates than those identified in the ICF analysis. For the sake of public transparency and ensuring that lifecycle GHG emissions associated with this project are minimized and that the potential GHG benefits Vermont Gas claims it will provide are achieved, I recommend that the Public Service Board include as a condition of any Certificate of Public Good issued for the Project, that Vermont Gas provide the Public Service Board and ANR with, an annual report containing data which would include, at a minimum, the following:

A) an annual breakout of the total quantity of natural gas purchased (from each natural gas source or producer) and sold by Vermont Gas to all customers;

B) the annual natural gas throughput (both volume purchased and sold) by Vermont Gas associated with this project;

C) a summary of total annual GHG emissions and methane leakage rates from each natural gas source or producer that supplies natural gas to Vermont Gas,

D) a summary or log of Vermont Gas' annual natural gas leaks (repaired and unrepaired), including cause, estimated volume released, and duration; and

E) a summary or log of natural gas releases due to normal operations and maintenance, including cause and estimated volume released.

The above conditions which will require Vermont Gas to provide more accurate data would inform a number of state efforts towards more accurately accounting for and reducing GHG emissions, including ANR's legislative requirement to track GHG emissions and produce an annual report; and policy discussions that are part of the Public Service Department's Comprehensive Energy Plan, Total Energy Study, etc.

Q13. Does that conclude your testimony?

A13. Yes.