

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
NO_x EMISSIONS FROM STATIONARY) R07-18
RECIPROCATING INTERNAL COMBUSTION) (Rulemaking – Air)
ENGINES AND TURBINES:)
AMENDMENTS TO 35 ILL.ADM.CODE)
SECTION 201.146 AND PARTS 211 AND 217.)

NOTICE OF FILING

To:

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Persons included on the
ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that we have today filed with the Office of the Clerk of the Pollution Control Board the **TESTIMONY OF JAMES McCARTHY**.


Kathleen C. Bassi

Dated: June 8, 2007

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TESTIMONY OF JAMES McCARTHY

My name is James McCarthy. I am a Principal with Innovative Environmental Solutions, Incorporated (“IES”). IES specializes in air quality and greenhouse gas emission consulting on energy-related issues and technical facilitation of regulatory development, with a focus on the natural gas industrial sector. IES is located in Cary, Illinois and I have been with the company for over five years. Prior to IES, from 1994 through 2002, I managed the air quality research and development (“R&D”) program for the Gas Research Institute (“GRI”), which was located in Chicago. GRI was a Federal Energy Regulatory Commission (“FERC”) regulated non-profit organization that planned, managed and directed R&D programs for the benefit of natural gas consumers. GRI was funded by a FERC sanctioned surcharge on natural gas deliveries. The characterization, control, costs, and environmental impact of air emissions associated with the type of equipment impacted by the Illinois Environmental Protection Agency (“IEPA”) proposal were a primary component of the GRI R&D program under my direction. This research included development of retrofit control technologies to reduce emissions of nitrogen oxides (“NO_x”) for natural gas-fired reciprocating internal combustion engines (“IC engines”), which are the primary type of equipment affected by IEPA’s proposed rule. The GRI program also supported technical research and regulatory facilitation associated with the U.S. Environmental Protection

Agency's ("U.S. EPA") NO_x SIP Call Phase II Rule ("Phase II Rule") (69 Fed.Reg. 21604 (April 21, 2004)). Prior to GRI, I was an engineering manager in compliance and planning with the Santa Barbara County, California, Air Pollution Control District and an R&D manager and engineer in private industry addressing air quality and waste management challenges for combustion sources. I hold multiple patents related to air emissions control and measurement. A native of Illinois, I have a Bachelor of Science degree in Chemical Engineering from the University of California at San Diego, with graduate studies in respiratory toxicology.

IES has worked with a group of natural gas transmission and storage companies since the summer of 2005 to provide technical and regulatory analysis and support associated with the Subpart Q rulemaking rulemaking that is the subject of this hearing and my testimony today. My testimony today is on behalf of a group of natural gas transmission companies ("Pipeline Group"): ANR Pipeline Company, Kinder Morgan, Incorporated, Trunkline Gas Company, and Panhandle Eastern Company. The objective of my testimony is to provide background on the affected industry and its proactive approach to addressing air emissions, as well as the Pipeline Group's perspective on the IEPA proposal.

In the Phase II Rule, the U.S. EPA requires subject states to develop a SIP to address a NO_x emissions budget commensurate with an 82% NO_x reduction from large natural gas-fired IC engines – *i.e.*, those IC engines in 21 eastern states and the District of Columbia that emitted greater than one ton per day of NO_x emissions, on average, during the 1995 ozone season based on U.S. EPA's inventory. U.S. EPA developed a model rule to assist states in developing the required SIP, and identified these units as "Large NO_x SIP Call Engines." About 90% of the approximately 188 Large NO_x SIP Call Engines throughout the SIP Call region are from the natural gas industrial sector, where IC engines are used to drive natural gas compressors. These

compressors are located at gas transmission compressor stations and storage facilities located along the U.S. gas transmission system. The interstate system is regulated by FERC and ensures the safe and reliable transportation and delivery of natural gas from producing areas to natural gas residential, commercial, industrial, and utility customers in Illinois and throughout the United States.

The Pipeline Group operates IC engines at natural gas compressor stations and storage facilities in Illinois. Current generation IC engines are typically 4-stroke cycle, higher speed, separable engines, where the IC engine and driven equipment (e.g., a compressor, pump, or electric generator) are separate units. Natural gas compressor drivers operated by the Pipeline Group in Illinois are typically 2-stroke cycle or 4-stroke cycle, slow speed, large cylinder bore, integral units, where the engine and compressor are integrated into a single piece of equipment with one crank shaft. The Appendix G affected units are nearly all 2-stroke cycle engines. These slow speed, large bore, integral units were uniquely designed and developed for gas compression and are no longer manufactured. Within the U.S. gas transmission system, the majority of the IC engines were installed when primary components of the U.S. interstate pipeline system were developed from the 1940's through about 1970. The continued operability of these units is essential to our national energy infrastructure and its reliability.

Natural gas industry IC engines comprise 25 of the 28 Illinois units identified by the U.S. EPA in the Phase II Rule, and these same 25 units are Appendix G affected units per the IEPA proposal. The 25 engines comprise less than fifteen percent of the IC engines at Illinois natural gas industry facilities, and the affected units are relatively large and highly utilized units. Note that the IEPA Technical Support Document ("TSD") for the proposal (*see* Section 2.2, page 17) implies a 1500 horsepower ("hp") size threshold for SIP Call Engines. However, Large NOx

SIP Call Engines are considerably larger than the TSD implies. Background information associated with the federal Phase I and Phase II rules indicates SIP Call engines as 2400 hp and larger, not smaller as implied by the TSD. Assuming a typical uncontrolled NOx emission rate, for an IC engine to be identified as a Large SIP Call Engine in the 1995 inventory, a 2400 hp unit would require full utilization throughout the ozone season to achieve a one ton per day average NOx emission rate. The average size of the 25 natural gas industry Appendix G units is larger than 4000 hp, and only three of the 25 units are smaller than 3400 hp. Thus, Large NOx SIP Call Engines and the Appendix G engines are larger capacity, more highly utilized engines as compared to other engines within the natural gas transmission and storage system.

High utilization is not typical of gas transmission compressor drivers, as FERC requires that pipeline systems be designed to meet peak natural gas delivery demand. It is common for equipment to be idle due to the excess system capacity relative to typical delivery requirements. Thus, Large NOx SIP Call engines are typically co-located with additional IC engines or combustion turbines at the facility, and many of the co-located units may exhibit low or minimal utilization. This is the case for the Appendix G affected units as well. In addition, historical gas demand is typically characterized by lower utilization during the ozone season, with gas demand and use increasing during the winter heating season.

In recent years, emissions technology advances for the existing infrastructure have primarily been driven by natural gas transmission companies. Because of the unique nature of IC engines in natural gas transmission and storage and lack of manufacturer support, the natural gas industry has a legacy of commitment to R&D. This has advanced the technological status for existing equipment, including an ongoing dedication to advancing emission reduction technologies for the prevalent slow speed, integral IC engines. This proactive approach to

technology development is a pragmatic objective to protect the specialized infrastructure and ensure the availability and operability of a key physical industry asset: the IC engines that drive compressors and provide natural gas to markets throughout the U.S. Thus, the technology used to reduce NOx emissions from natural gas industry IC engines, including the Appendix G affected units, has primarily been developed through industry supported research with academic institutions such as the Colorado State University Large Bore Engine Testbed and Kansas State University National Gas Machinery Laboratory, as well as niche aftermarket service providers that have filled the market gap left by the previous manufacturers.

These efforts have resulted in the development and enhancement of Low Emission Combustion (“LEC”) technology for retrofit application to natural gas industry IC engines. Through these efforts, the Pipeline Group has extensive experience in the retrofit application of air pollution controls on natural gas-fired IC engines and in the installation of new engines that incorporate the latest emissions control technologies. This proactive approach and commitment to emissions issues is also apparent through the Pipeline Group’s proactive approach to emission reductions in Illinois for the 25 Large SIP Call Engines identified in Appendix G of the proposal.

The federal Phase II Rule does not mandate control of Large SIP Call Engines, but rather that each SIP Call state develop a plan and adopt regulations to achieve a federally mandated NOx budget. The U.S. EPA required states to submit the Phase II Rule SIP by April 1, 2005, with a regulatory compliance deadline of the May 1, 2007, which was the start of this year’s ozone season. While IEPA has not met these obligations, the natural gas companies that operate the Appendix G affected units in Illinois undertook a proactive approach.

Primarily through its trade association, the Interstate Natural Gas Association of America (“INGAA”), the natural gas industry was actively engaged in U.S. EPA’s development of the

Phase II Rule through meetings and by providing background support information on gas transmission IC engines to the agency. INGAA also provided comment when U.S. EPA chose to develop a model rule in September 2004 to assist states with SIP development. Based on familiarity with the federally recommended approach, the eight natural gas transmission and storage facilities in Illinois that operate Large NOx SIP Call Engines have proactively initiated projects to install emission controls and reduce NOx in conformance with the federal program intent. These actions were not required by any regulatory mandate.

Thus, despite the lack of an IEPA rule, the affected natural gas companies have proactively initiated reduction programs and compliance plans for the units in Appendix G of the proposal. The Pipeline Group has also worked cooperatively with IEPA since 2005 to integrate provisions consistent with federal guidance and the model rule into the IEPA proposal, and compliance approaches for the Appendix G units include compliance with the applicable emission limit in the proposal, which is commensurate with U.S. EPA's 82% average reduction target, as well as emissions averaging approaches that achieve emission reductions by controlling or replacing other or additional units. Emissions averaging is consistent with federal guidance and the IEPA proposal. Averaging acknowledges that the Phase II Rule 82% reduction target is an average level of emission performance across many engines, acknowledges that unique technical challenges preclude all of the broad variety of legacy IC engines in the natural gas industry from achieving 82% NOx reduction, and provides operators the ability to most cost-effectively implement controls and address emission requirements. The Pipeline Group is assisting IEPA in documenting the status of the natural gas industry Appendix G affected units to facilitate IEPA's communication with U.S. EPA regarding the federal Phase II Rule and 2007 ozone season emissions.

In regard to the IEPA proposal under consideration at this hearing, the Pipeline Group does not object to the Subpart Q proposal under consideration at today's hearing. As noted earlier, the Pipeline Group has worked with IEPA to integrate compliance options that promote consistency with the federal Phase II Rule and associated federal guidance.

However, there are several items regarding the proposal that we would like to highlight to ensure that the public record for the proposal is consistent with our understanding of the federal Phase II Rule and control technology applicability.

First, as noted above, the engine size associated with the Phase II Rule is 2400 hp or larger, and not 1500 hp as indicated in the TSD. Combustion turbines are also used to drive natural gas compressors, and turbines larger than 25 MW were addressed by Phase I of the NOx SIP Call rulemaking. There are no gas transmission turbines that large in Illinois, and turbines are not affected units under the federal Phase II Rule or IEPA proposal.

Second, the Phase II Rule addresses ozone transport concerns and thus requires NOx budget conformance for only the ozone season. The IEPA proposal includes both ozone season and annual requirements, with associated reporting and recordkeeping. We note that the control strategies employed by the natural gas companies are operational whenever the unit operates, and so emission reductions will not be limited to the ozone season. However, relative to federal requirements, the Illinois proposal imposes an additional compliance burden in the annual compliance requirement.

In addition, the IEPA TSD describes emission control technologies that are not necessarily proven controls for application to natural gas transmission and storage IC engines. Selective Catalytic Reduction ("SCR") is included as an applicable control technology for IC engines. However, to date, SCR has not been successfully applied to gas transmission units, and

U.S. EPA has acknowledged this limitation. In a 2002 notice regarding the NO_x SIP Call that discusses large IC engines affected by the standard, U.S. EPA states:

[T]hese engines (lean-burn IC engines in natural gas transmission) experience frequently changing load conditions which make application of SCR infeasible. . . . [O]ur ACT document states that little data exist with which to evaluate application of SCR for the lean-burn, variable load operations. We now believe that there is an insufficient basis to conclude that SCR is an appropriate technology for large lean-burn engines.

67 Fed.Reg. 8395, 8411 (February 22, 2002).

In addition, Section 3.2.4.2 of the July 2000 version of the EPA AP-42 document, which discusses control techniques for lean-burn IC engines, states:

For engines which typically operate at variable loads, such as engines on gas transmission pipelines, an SCR system may not function effectively, causing either periods of ammonia slip or insufficient ammonia to gain the reductions needed.

Other NO_x control technologies included in the TSD also are questionable in regard to applicability to natural gas-fired IC engines. For example, ignition timing retard may not provide meaningful emission reductions, and the commercial availability and performance of prestratified charge are questionable.

Finally, the TSD for the proposal includes a section regarding the cost and cost-effectiveness of NO_x emission controls. A detailed assessment of the TSD discussion is not provided here, but it is important to clarify one point. The TSD (section 5.1, page 40) indicates that a \$5000 per ton basis is used for IC engines under the NO_x SIP Call. This is not consistent with the federal 2004 Phase II Rule or the original federal SIP Call Rule in 1998 (63 Fed.Reg. 57356 (October 27, 1998)). For example, the Phase II Rule indicates that “[EPA] determined that an average of approximately \$2,000 per ton removed is highly cost effective.” (69 Fed.Reg. 21604, 21618 (April 21, 2004)).

There are additional cost issues that may warrant additional consideration and clarification, such as the calendar year basis for the cost estimate, but the difference between the noted IEPA value and SIP Call record is significant.

In closing, we reiterate that the efforts of the Pipeline Group to develop a functional and effective rule to address Large NOx SIP Call Engines are evident through multiple meetings with IEPA and Pipeline Group's comments submitted to IEPA since August 2005. The Pipeline Group's intentions are apparent through proactive emission reduction projects that will reduce 2007 ozone season emissions in Illinois. This proactive effort by natural gas companies has culminated in a workable proposal and will assist IEPA in addressing federal obligations under the NOx SIP Call Phase II Rule.

CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 8th day of June, 2007, I have served electronically the attached **TESTIMONY OF JAMES McCARTHY** upon the following persons:

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