BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
NOx EMISSIONS FROM STATIONARY	)	**R07-19**
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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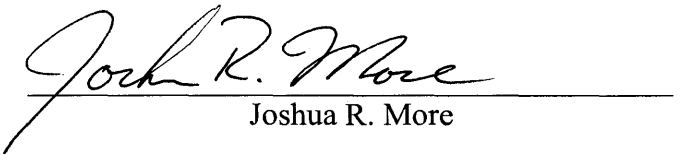
PLEASE TAKE NOTICE that we have today filed with the Office of the Clerk of the Pollution Control Board the **PRE-FILED TESTIMONY OF JAMES McCARTHY**.



Joshua R. More

Dated: April 23, 2008

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CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 23rd day of April, 2008, I have served electronically the attached **PRE-FILED TESTIMONY OF JAMES McCARTHY** upon the following persons:

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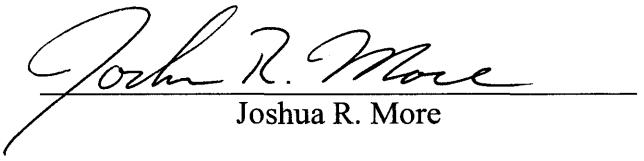

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
SECTION 27 PROPOSED RULES FOR	)	**R07-19**
NITROGEN OXIDE (NOx) EMISSIONS	)	**(Rulemaking – Air)**
FROM STATIONARY RECIPROCATING	)	
INTERNAL COMBUSTION ENGINES AND	)	
TURBINES: AMENDMENTS TO 35 ILL.	)	
ADM. CODE PARTS 211 AND 217	)	

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. I am co-owner and have been with IES for six 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 ("NOx") for natural gas-fired reciprocating internal combustion engines ("IC engines"), which are the

primary type of equipment affected by IEPA's proposed rule. Stationary combustion turbines ("turbines") are also affected by the proposed rule, and the GRI program included development of retrofit NOx control technologies for combustion turbines in conjunction with leading turbine manufacturers. 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. I am an Illinois native and 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 IEPA proposed rulemaking that is the subject of this hearing and my testimony today. My testimony today is on behalf of two natural gas transmission companies ("Pipeline Group"): ANR Pipeline Company and Natural Gas Pipeline Company of America. 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 R07-19.

The Pipeline Group operates IC engines and turbines at natural gas compressor stations 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 in natural gas transmission) 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. 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. Turbines used in gas transmission are small industrial scale units, with capacity and emissions much lower than turbines used in other sectors such as electric utilities. The characteristics of compressor station equipment are important because of the implications on control technology applicability and economic feasibility for retrofit application of emission controls at compressor stations. The continued operability of these units is essential to our national energy infrastructure and its reliability.

Because of the unique attributes of compressor drivers in gas transmission, emissions technology advances for the existing IC engine infrastructure have primarily been due to efforts of natural gas transmission companies. 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. In addition, natural gas companies have worked with leading manufacturers of small industrial turbines to develop and demonstrate retrofit NOx controls for turbines. 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 and turbines that drive compressors and provide natural gas to markets throughout the U.S. For IC engines, the technology used to reduce NOx emissions from natural gas compressor drivers 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 commercial 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, and the development of Dry Low NOx Combustors ("DLN") for turbines. Through both R&D and the application of the technologies within the pipeline system, the Pipeline Group has extensive experience in the retrofit application of air pollution controls on natural gas-fired IC engines and turbines, and in the installation of new units that incorporate the latest emission control technologies. This proactive approach and commitment to emissions issues is also apparent through the proactive approach to emission reductions in Illinois for the large engines affected by Subpart Q under the R07-18 rulemaking in 2007. For those engines, natural gas industry sources implemented early reductions at a number of facilities and assisted IEPA in communicating with the U.S. EPA regarding status of control implementation that addresses requirements in the federal NOx SIP Call Phase 2 Rule.

In addition to technology issues, the operational attributes of gas transmission compressor stations warrant special consideration. The pipeline system is regulated by FERC, who requires that pipeline systems be designed to meet peak natural gas delivery demand. Thus, the system is designed with additional capacity relative to the norm or average demand. Because of this, high utilization is not typical or expected for many gas transmission compressor drivers. Historical gas demand is typically characterized by lower utilization during the ozone season, with gas demand and use increasing during the winter heating season. It is common for equipment to be idle due to the excess system capacity inherent to the system during non-peak times. Thus, some compressor stations may run sporadically or not at all over extended periods depending upon gas

demand and seasonal markets. At some facilities, larger IC engines or turbines that run more regularly can be co-located with other IC engines or turbines at the facility that exhibit low or minimal utilization. Because of system operational characteristics, it is not reasonable or economically feasible to require retrofit control of all units, as low-use units would bear the burden of significant cost while not providing meaningful emission reductions, especially during the ozone season.

In addition, the response of IC engines and turbines to emission controls varies for different manufacturers and models. Unit-specific technology costs and performance can vary dramatically for the slow speed, integral IC engines prevalent in gas transmission. Due to both technology and operational limitations, it is imperative that NOx regulations include flexible options to facilitate compliance without undue burden. We note that IEPA has properly considered an example of performance limitations by including a less stringent NOx standard under Section 217.388(a)(3) for a certain engine type found in the gas transmission sector.

Similar to the R07-18 rulemaking, the Pipeline Group was dedicated to working constructively with IEPA to identify regulatory approaches for the R07-19 rulemaking. It was imperative that the rule achieve the needed NOx reductions while providing flexibility to the affected sources. The proposed rule includes several notable provisions in this regard: (1) emissions averaging in Section 217.388(b); (2) low-usage criteria in Section 217.388(c); and, (3) under Section 217.392(c), the limited use of NOx allowances when anomalous situations pose problems with emissions averaging or low-usage requirements. These provisions are necessary for a workable rule, and the Pipeline Group strongly supports their inclusion in Subpart Q. In addition to these provisions, the Pipeline Group notes that rule applicability is limited to nonattainment areas. This applicability criterion was adamantly supported by the Pipeline Group

throughout rule development, and substantiated by regional air quality modeling completed in the fall of 2007.

The Pipeline Group does not object to the IEPA Subpart Q proposal under consideration at today's hearing. As noted above, the Pipeline Group has worked with IEPA to integrate compliance options that provide compliance flexibility and address some of the unique technology and operating attributes and limitations of the natural gas transmission sector. However, there are several items of interest associated with the IEPA proposal that we would like to highlight to ensure that our remaining concerns are identified.

First, the applicability threshold of 500 horsepower ("hp") for IC engines and 3.5 megawatts ("MW") for turbines capture relatively small sources. By limiting the proposal to applicability only within nonattainment areas, the impact of these capacity thresholds is limited. However, the Pipeline Group notes that IEPA was pursuing broader applicability during rule development, without reasonable substantiation of the need for controls at these capacity thresholds. We firmly believe that larger units for both IC engines and turbines provide the most cost effective and environmentally beneficial avenue for emission reductions, and question the basis and legitimacy of a 500 hp IC engine threshold and 3.5 MW turbine threshold. However, the geographical applicability limitation and low usage criteria partially ameliorate our concerns and thus the Pipeline Group does not strenuously object here, though the question of justifying such low thresholds remains.

In addition, we offer several comments on the IEPA Technical Support Document ("TSD") in regard to emission control technologies. Several technologies discussed in the TSD are not proven for application to natural gas transmission IC engines and turbines or are of limited or no benefit. Selective Catalytic Reduction ("SCR") is included as an applicable control

technology for both IC engines and turbines. 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 NOx SIP Call that discusses large IC engines affected by that regulation, 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.

Thus, although SCR is marketed for application to IC engines, it has not been demonstrated on retrofit units in service at a natural gas transmission compressor station. SCR has been installed on a gas transmission turbine in California, but that application has been fraught with technical difficulties. This has resulted in significant site-specific re-engineering that has resulted in exorbitant costs and a relaxation of the initial emission limits. A very recent installation on new IC engines at a compressor station in the eastern U.S. has had very limited operation, i.e., the station only operates when gas demand is very high. Thus, based on the U.S. EPA record and very limited industry experience, SCR is not a demonstrated technology for retrofit application to IC engines or turbines in gas transmission. Additional engineering facts

are available to substantiate concerns about SCR applicability and performance and the immature status of SCR technology for gas transmission applications.

For turbines, water or steam injection is also identified as a NOx control technology. This technology is a "first generation" retrofit control that introduces operational, efficiency, and emissions challenges. It has been supplanted by DLN technology and, to our knowledge, water or steam injection has not been applied to any turbines in gas transmission. In addition, some of the NOx control technologies included in the TSD 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 technology are questionable.

In closing, we reiterate that the efforts of the Pipeline Group to develop a functional and effective rule that addresses IC engine and turbine emissions in nonattainment areas are evident through multiple meetings with IEPA and Pipeline Group comments submitted to IEPA since August 2005. The Pipeline Group's intentions are apparent through proactive emission reduction projects associated with the initial Subpart Q rulemaking in R07-18 and ongoing dialogue with IEPA to facilitate the R07-19 rulemaking considered in the current IEPA proposal. This proactive effort by natural gas companies and IEPA's willingness to consider the technical veracity of our positions has culminated in a workable proposal that will assist IEPA in fulfilling state implementation plan obligations mandated by the Clean Air Act.