





**BEFORE THE ILLINOIS POLLUTION CONTROL BOARD**

**IN THE MATTER OF:** )  
 )  
SECTION 27 PROPOSED RULES FOR )  
NITROGEN OXIDE (NO<sub>x</sub>) EMISSIONS ) R07-19  
FROM STATIONARY RECIPROCATING ) (Rulemaking-Air)  
INTERNAL COMBUSTION ENGINES )  
AND TURBINES: AMENDMENTS TO )  
35 ILL. ADM. CODE PARTS 211 AND 217 )

**TESTIMONY OF ROBERT KALEEL**

My name is Robert Kaleel. I am the Manager of the Air Quality Planning Section, Division of Air Pollution Control, Bureau of Air at the Illinois Environmental Protection Agency (“Illinois EPA”), Springfield, Illinois. I have a Bachelor of Science degree in meteorology from Northern Illinois University. I have worked at the Illinois EPA for more than 26 years, and have been in my present position since 2004. Prior to that, I was the Manager of the Air Quality Modeling Unit in the Air Quality Planning Section, a position that I held for more than 15 years. I have also worked as a private consultant as a specialist in air quality modeling. As Manager of the Air Quality Planning Section, my responsibilities include oversight of staff that provides technical support for regulatory initiatives needed to address air quality issues in Illinois, including the regulatory proposal before the Illinois Pollution Control Board (“Board”) at this hearing. The Air Quality Planning Section also provides technical support to the Bureau of Air’s permitting and enforcement functions, and is responsible for maintaining the Bureau’s emission inventory system, including Annual Emission Reports. I have been closely involved with the development of Illinois’ State Implementation Plans (“SIPs”) to address the PM<sub>2.5</sub> and ozone nonattainment areas in Illinois.

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My testimony will explain the purpose of this proposal, and describe the components of the proposed rule. Included in this proposal are amendments to 35 Ill. Adm. Code Section 201.146, and Parts 211 and 217. Adoption of the proposed rules will reduce emissions of nitrogen oxides (“NO<sub>x</sub>”) from stationary reciprocating internal combustion engines and turbines located in the Chicago and Metro-East ozone and PM<sub>2.5</sub> nonattainment areas. This proposal is intended to address, in part, Illinois’ obligation to meet certain requirements under the federal Clean Air Act (“CAA”), specifically the requirements for reasonably available control technology (“RACT”) for these source categories.

On July 18, 1997, United States Environmental Protection Agency (“USEPA”) promulgated revised primary and secondary ozone National Ambient Air Quality Standards (“NAAQS”) that increased the averaging period for the ozone standard from 1-hour to 8-hour and lowered the concentration for violations from 0.12 to 0.08 parts per million (“ppm”). It has long been recognized that volatile organic material (“VOM”) and NO<sub>x</sub> are the primary precursors responsible for the formation of ground level ozone. Illinois has two areas (greater Chicago and Metro East/St. Louis), consisting of 12 counties or partial counties, that were designated as nonattainment areas for the 8-hour ozone standard. The designations were effective on June 15, 2004. The two areas in Illinois are classified as moderate nonattainment areas.

On July 18, 1997, USEPA also added a new 24-hour and a new annual NAAQS for fine particles, using as the indicator particles with aerodynamic diameters smaller than a nominal 2.5 micrometers, termed PM<sub>2.5</sub>. In October 2006, USEPA subsequently completed another review of the NAAQS for particulate matter, and as a result, strengthened the 24-hour standard (hereinafter “PM<sub>2.5</sub> 2006”). 71 *Fed. Reg.* 61144 (October 17, 2006).

USEPA has determined that, in addition to direct particulate matter, that NO<sub>x</sub>, sulfur

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dioxide (“SO<sub>2</sub>”), VOCs, and ammonia are precursors to the formation of PM<sub>2.5</sub>. States are required to address NO<sub>x</sub>, SO<sub>2</sub>, and direct emissions of PM<sub>2.5</sub> in their attainment plans to address the 1997 PM<sub>2.5</sub> NAAQS. USEPA designated two areas in Illinois (greater Chicago and Metro East/St. Louis), consisting of 12 counties or partial counties within Illinois, as not attaining the PM<sub>2.5</sub> standard. The designations became effective on April 5, 2005. The attainment demonstration is due April 5, 2008, and the attainment date for most areas is April 5, 2010.

This proposed rulemaking is intended to meet certain obligations of the State of Illinois under the CAA, 42 U.S.C. § 7401 *et seq.*; specifically, to satisfy Illinois’ obligation to submit a SIP to address the requirements under Sections 172 and 182 of the CAA for major stationary sources of NO<sub>x</sub> in areas designated as nonattainment with respect to the NAAQS. *See*, 42 U.S.C. §§ 7502 and 7511a. Under Section 110 of the CAA and related provisions, states are required to submit for USEPA’s approval, SIPs that provide for the attainment and maintenance of standards established by USEPA through control programs directed to sources of the pollutants involved. 42 U.S.C. §7410. The CAA also provides for the State to address emissions sources on an area-specific basis through such requirements as reasonably available control measures (“RACM”) and RACT. *See*, 42 U.S.C. §§7502 and 7511a. For each nonattainment area, the CAA requires the State to demonstrate that it has adopted “all reasonably available control measures as expeditiously as possible (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology) and shall provide for attainment of the national primary ambient air quality standards.” 42 U.S.C. § 7502(c)(1).

The Illinois EPA has formulated a thorough regulatory approach to comply with the State’s requirements under the CAA, and as such, is proposing reasonable and cost effective NO<sub>x</sub>

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controls on various source categories. Control of engines and turbines is one element of Illinois EPA's regulatory approach to implement RACT in ozone and PM<sub>2.5</sub> nonattainment areas. In addition, the Illinois EPA has developed a regulatory proposal that will be addressed in a separate Board rulemaking to implement RACT affecting other major stationary source categories, such as industrial boilers, process heaters, glass melting furnaces, cement kilns, lime kilns, furnaces used in steel making and aluminum melting, and fossil fuel-fired stationary boilers.

The NO<sub>x</sub> control approach in this proposal for engines and turbines is consistent with the Board's recently adopted rulemaking affecting large engines subject to Phase II of the NO<sub>x</sub> SIP Call. *See*, R07-18, *In the Matter of: Fast-Track Rules Under Nitrogen Oxide (NO<sub>x</sub>) SIP Call Phase II: Amendments to 35 Ill. Adm. Code Section 201.146 and Parts 211 and 217*. The Illinois EPA has proposed in this rulemaking that turbines and engines not subject to Phase II of the NO<sub>x</sub> SIP Call be subject to NO<sub>x</sub> emissions limits at the same level as that required by R07-18 which met the State's obligations under Phase II of the NO<sub>x</sub> SIP Call. As demonstrated in the Technical Support Document submitted with this proposal, the NO<sub>x</sub> SIP Call emission limits are cost effective and technologically feasible for the emission units affected by this proposal.

The geographic region subject to "Subpart Q: Stationary Reciprocating Internal Combustion Engines and Turbines" are the counties, or portions thereof, that are designated as nonattainment of the ozone and PM<sub>2.5</sub>NAAQS. Emissions of NO<sub>x</sub> from stationary internal combustion engines are not currently regulated in the State of Illinois. The proposed regulations will affect existing and new units. The Illinois EPA estimates that there are approximately 63 stationary engines, and about 58 turbines that may be affected by this proposal. The estimated reduction of NO<sub>x</sub> emissions from the affected units is about 1,020 tons per ozone control season,

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and 2,155 tons annually.

The Illinois EPA has determined that affected engines and turbines can meet the requirements of proposed Subpart Q through a combination of control techniques such that compliance is both technically feasible and economically reasonable. Based on USEPA's Alternative Control Techniques document there are a number of control options available which achieve the control levels proposed in this rulemaking in the range of unit sizes affected. In addition, the Illinois EPA found that the levels proposed in this rule were consistent with rules promulgated in other states. The Illinois EPA considers the control requirements of this proposal to be technically feasible and economically reasonable.

The proposal being considered today is the result of an extensive stakeholder process. Throughout the development of the rule, the Illinois EPA has sought and received comments from interested parties. The Illinois EPA held three general meetings (August 25, 2005, October 5, 2005, and November 14, 2005) to which owners and operators of affected units and environmental groups were invited. At least three additional meetings were held at the request of particular groups or companies affected by this proposal. The Illinois EPA's proposal was amended several times in response to comments provided by stakeholders. It is my understanding that the parties have reached agreement on the major components of the proposal.

The Illinois EPA is amending Subpart Q: Stationary Reciprocating Internal Combustion Engines and Turbines to Part 217. The rule is intended to apply to stationary reciprocating internal combustion engines rated 500 brakehorsepower and above, and turbines rated 3.5 MW and above. The Illinois EPA is proposing separate concentration limits for different types of engines and turbines, and based on the kind of fuel used.

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The Illinois EPA recognizes that some of the engines and turbines in use in Illinois operate only intermittently and may not be cost-effective to control. To reduce compliance costs, the proposal provides a number of exemptions and compliance options. Proposed exemptions are offered for emergency and standby units, units used for research or performance verification, units that are used primarily to control gas from landfills, units used for agricultural purposes, and portable units. The Illinois EPA is also proposing special requirements for low usage units where the potential to emit from all engines and turbines at a source is below 100 ton per year of NO<sub>x</sub> emissions. Low usage units may also be exempt from the requirements to meet the emission limits if the aggregate usage of all the uncontrolled affected units are below specified thresholds.

The proposal includes alternate compliance options which provide companies with flexibility in reducing their compliance costs. The proposal allows owners and operators the option to comply with an emissions averaging plan in lieu of meeting the specified concentration limit for each affected unit. Units located in Illinois that commenced operation before January 1, 2002, and are owned by the same company or parent company, can in most cases be included in an averaging plan. An averaging plan must insure that the total mass of actual NO<sub>x</sub> emissions from all affected units included in the emissions averaging plan must be less than the total mass of allowable NO<sub>x</sub> emissions for the same units. The proposal contains specific formulas for making the calculations needed to demonstrate compliance. This option will allow owners to control units that are most cost effective to control, and reduce or avoid control costs for units that are more expensive to control.

Another compliance option proposed in the rule allows owners and operators to use NO<sub>x</sub> SIP Call allowances to meet the compliance requirements if they meet certain criteria. This

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option is intended to provide flexibility to owners and operators when noncompliance is due to unforeseen circumstances. An owner or operator can use this option up to two times in any five-year rolling period. The applicable type of NO<sub>x</sub> allowances must be used, that is, annual allowances must be used for exceedances of an annual limit and ozone season allowances must be used for exceedances of a seasonal limit. This option is included in the proposal at the suggestion of stakeholders and will again provide increased operating flexibility and will reduce compliance costs.

The Illinois EPA is proposing a compliance date of May 1, 2010. The proposal also provides a flexible approach for meeting the requirements for testing and monitoring. In general, affected units must conduct a compliance test by the applicable compliance date. Affected units that operate intermittently do not need to be tested until after they have operated at least 876 hours in a year. Units that operate less than 876 hours per calendar year can be tested at the owner's or operator's choosing any time within the first five years after the applicable compliance date. In years in which a compliance test is not performed, the proposal requires that an inexpensive portable NO<sub>x</sub> monitor be used annually to verify continued compliance. For units that operate less than 876 hours per calendar year, monitoring is required only once every five years.

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**TESTIMONY OF YOGINDER MAHAJAN**

Good Morning. My name is Yoginder Mahajan. I am employed as an Environmental Protection Engineer in the Air Quality Planning Section in the Bureau of Air of the Illinois Environmental Protection Agency (Illinois EPA). I have been employed in this capacity since March 1992. Prior to my employment with the Illinois EPA, I worked for various metal fabrication industries for nine (9) years. My educational background includes a Bachelor of Engineering Degree in Mechanical Engineering from Bhopal University at Bhopal, India.

As part of my regular duties in the Air Quality Planning Section, I have been involved with preparing emissions estimates for various source categories used in the development of the 1990 ozone season weekday emissions inventories; evaluating control technologies applicable to volatile organic material (VOM) emissions sources utilized in the preparation of the Rate-of-Progress plans for the greater Chicago and Metro/St. Louis ozone nonattainment areas; and assisting in the development of regulations for the control of VOM emissions from the source categories included in the Rate-of-Progress plans. Regarding the proposal before you today, I have been involved in the development of the regulations to control nitrogen oxides (NO<sub>x</sub>) from stationary reciprocating internal combustion engines (RICE) and turbines. I provided the list of

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affected sources for the proposal and technical feasibility of NO<sub>x</sub> controls for the Technical Support Document (TSD) for the proposal.

RICE and turbines are used throughout the United States to drive compressors, pumps, electric generators and other equipment. In Illinois, a prominent use of large engines is to drive natural gas pipeline compressors. Emissions of NO<sub>x</sub> are the result of combustion of fuel at high temperatures and pressures in the RICE and turbines, which cause the nitrogen and oxygen in the air that sustains the combustion to unite and form the various oxides of nitrogen that constitute NO<sub>x</sub>.

Today's proposal is to control NO<sub>x</sub> emissions from sources in the nonattainment areas (NAA) of National Ambient Air Quality Standards for eight-hour ozone and PM<sub>2.5</sub> that have a potential to emit 100 tons or more per year of NO<sub>x</sub> and have RICE of 500 brake horse power (bhp) capacities and above, and stationary turbines of 3.5 megawatt (MW) capacities and above.

As part of evaluation of the control of NO<sub>x</sub> from RICE and turbines, the Illinois EPA identified several sources of guidance. The United States Environmental Protection Agency (U.S. EPA) published two Alternative Control Techniques (ACT) documents - NO<sub>x</sub> Emissions from Stationary Reciprocating Internal Combustion engines, and NO<sub>x</sub> Emissions from Stationary Gas Turbines. Another source that was utilized was Controlling Nitrogen Oxides Under the Clean Air Act: A Menu of Options, a document published by State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Official. These documents contain detailed information on the description of sources of NO<sub>x</sub> emissions, various techniques of controlling NO<sub>x</sub>, and the costs of various controls. The Illinois EPA relied upon the information contained in these documents for the proposed level of NO<sub>x</sub> controls, costs and economic impacts for this proposal.

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For reciprocating engines and turbines, both combustion controls and post-combustion catalytic reduction have been developed. For reciprocating engines, air/fuel ratio adjustments, low emission combustion, and prestratified charge all function by modifying the combustion zone air/fuel ratio, thus influencing oxygen availability and peak flame temperature. Ignition timing retard lowers the peak flame temperature by delaying the onset of combustion. For turbines, water/steam injection and dry low NO<sub>x</sub> combustors are the combustion control techniques to control NO<sub>x</sub> emissions. Selective catalytic reduction and non-selective catalytic reduction are the two post-combustion control strategies that destroy NO<sub>x</sub> once it has been formed for reciprocating internal combustion engines and turbines.

After reviewing the U.S. EPA's guidance documents, the Illinois EPA determined that there are cost effective NO<sub>x</sub> control techniques available to reduce NO<sub>x</sub> emissions from RICE and turbines. Lean burn spark-ignited RICE may install low emission combustion, rich burn spark-ignited RICE may use non-selective catalytic reduction, and compression ignited diesel RICE may use electronic injection techniques to cost-effectively comply with this proposal. For turbines, water/steam injection for oil/gas-fired turbines, and low NO<sub>x</sub> combustors for gas-fired turbines are available to cost-effectively comply with the proposal.

As shown in the table 7-1 of the TSD, the Illinois EPA's 2004 NO<sub>x</sub> inventory of sources in the greater Chicago and Metro-East/St. Louis NAAs contains 541 RICE. Also, the Illinois EPA estimated that there are 79 RICE greater than 500 bhp but less than 1,500 bhp-capacities which are not included in the inventory. In total, there are 620 RICE (541 + 79) that are potentially affected by this proposal. The Illinois EPA applied an exemption of approximately 100 tons NO<sub>x</sub> per year from all RICE at a facility and estimated that out of 541 RICE, 55 were actually impacted by this proposal. In addition, the, Illinois EPA estimated that eight RICE out

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of 79 of greater than 500 bhp capacity are not included in the Illinois EPA's inventory and may be impacted by this proposal. In total, 63 RICE are expected to be impacted by this proposal.

The Illinois EPA's 2004 NOx inventory of sources in the greater Chicago and Metro-East/St. Louis NAAs contains 220 turbines at industrial and electricity generating facilities that are potentially affected by this proposal. The Illinois EPA applied an exemption of approximately 100 tons NOx per year from all turbines at a facility and estimates that out of 220 turbines, 58 will be impacted by this proposal.

The Illinois EPA estimates that this proposal will provide a reduction of NOx emissions of 1,469 tons per year and 639 tons per ozone season from 63 RICE. The estimated cost effectiveness of NOx controls for RICE will be \$319 to \$2,575 per ton of NOx (in 2004 dollars), depending on the type and size of RICE.

The Illinois EPA estimates that this proposal will provide a reduction of NOx emissions from gas turbines by 686 tons per year and 381 tons per ozone season from 58 affected turbines at a cost effectiveness of \$314 to \$3,005 per ton of NOx (in 2004 dollars) depending on the type and size of the turbine.