Interstate Natural Gas Association of America

September 26, 2011

Alex Ryan-Bond
Ozone Transport Commission
Hall of the States, 444 North Capitol Street
Suite 638
Washington, DC 20001

Re: INGAA Comments on the OTC Model Rule for Control of NOx Emissions from Natural Gas Pipeline Compressor Fuel-Fired Prime Movers

Dear Mr. Ryan-Bond:

The Interstate Natural Gas Association of America (INGAA), a trade association of the interstate natural gas pipeline industry, respectfully submits these comments regarding the Ozone Transport Commission (OTC) Model Rule for Control of NOx Emissions from Natural Gas Pipeline Compressor Fuel-Fired Prime Movers (Model Rule).

INGAA member companies transport approximately 80 percent of the nation's natural gas, through some 200,000 miles of interstate natural gas pipelines. INGAA member companies operate over 6,000 stationary natural gas-fired spark ignition IC engines and 1,000 stationary natural gas-fired combustion turbines, which are installed at compressor stations along the pipelines to transport natural gas to residential, commercial, industrial and electric utility customers. In recent years, the natural gas transmission industry has worked with the U.S. EPA (EPA) and a number of eastern States on NOx rules related to emissions control from reciprocating engines and turbines, including the NOx SIP Call Phase 2 Rule, Reasonably Available Control Technology rules to address State Implementation Plan (SIP) requirements related to the ozone NAAQS, and federal NSPS and NESHAPs for spark ignited engines and turbines. Our efforts are driven by our extensive experience with implementation of retrofit technologies for reduction of emissions from natural gas pipeline reciprocating engines and turbines, and a longstanding commitment to research and development of control technologies for the equipment and operating profiles unique to natural gas compressor drivers.

INGAA welcomes the opportunity to provide these comments and additional information to improve OTC's understanding of natural gas transmission prime movers, including technology, emissions performance, and background on INGAA member operations in the OTC region. As detailed in the comments below, primary issues of concern include:

- The majority of natural gas transmission prime movers in the OTR are already controlled and we question the utility of the model rule;

- Emission limits should consider technology limitations for retrofit control of existing equipment;
- Flexible options such as emissions averaging should be included in the rule;
- Reasonable implementation will require later deadlines and phased compliance schedules; and,
- Compliance monitoring provisions should be more consistent with recent similar regulations.

INGAA Comments

1. **OTC should carefully assess the NOx reductions available from natural gas transmission prime movers in the region. INGAA's initial review of available data indicates that most compressor drivers in northeast states are already controlled, with controlled NOx emission levels marginally higher than the limits proposed in the Model Rule. Pursuing incremental reductions for these units would incur significant costs with minimal benefit. Limited available reductions raises questions regarding the need for the Model Rule.**

The Draft OTC White Paper prepared for the Model Rule was released in June 2011 and indicates that data gaps preclude an estimate of available reductions with a high level of certainty. INGAA has compiled data from members that comprise the vast majority of prime movers in the Ozone Transport Region. This data has been reviewed along with the Mid-Atlantic Regional Air Managment Association (MARAMA) emissions inventory for prime movers in natural gas transmission. INGAA's preliminary analysis indicates that the vast majority of prime movers and associated capacity are already controlled ï nominally to levels that are marginally higher than the proposed emission standards in the Model Rule. In addition, based on pipeline locations, compressor stations are predominantly located in a few OTC states, including New York where a statewide NOx RACT rule already applies. Due to the limited potential for reductions across the region, it is questionable whether a Model Rule is warranted. A summary of some of the initial conclusions and associated implications based on INGAA's data review follows.

Geographical Implications

Compressor stations in the Ozone Transport Region (OTR) are primarily located in New York, Pennsylvania, and Virginia. New York already requires statewide control under its NOx RACT rule, and the majority of prime movers are also controlled in Pennsylvania and Virginia. In addition, a number of engines at smaller facilities common in rural Pennsylvania are rich burn engines that will require non-selective catalytic reduction (NSCR) control by 2013 under the August 2010 RICE NESHAP regulation (40 CFR Part 63, Subpart ZZZZ). NSCR reduces NOx as well as organic hazardous air pollutant (HAP) emissions and is the same control technology that would be applied under the Model Rule for rich burn engines. There are fewer than 30 facilities in the rest of the OTR and these facilities already include NOx controls ï and often are newer facilities with state of the art emission controls. For example, Maine facilities on the

Maritimes & Northeast Pipeline and Connecticutt facilities on the Iroquois Pipeline use low NOx Solar turbines with emissions performance commensurate with the current state of the art. At most, emissions and potential reductions in Pennsylvania and Virgina may warrant additional review, along with one or two facilities across other OTR states. However, as discussed below, the review also indicates that the vast majority of equipment and emissions have already been controlled.

NOx Inventory Implications

In general, the MARAMA inventory reasonably captures the count and emissions of the existing fleet of equipment, but not the NOx control status. There are examples of small facilities and/or highly controlled minor source facilities that are not included in the inventory, but these are insignificant contributors to the inventory and do not offer any potential reductions.

The inventory does not provide an indication of whether facilities or units are already controlled. Not understanding the control status is significant because the vast majority of compressor station prime movers are already controlled, and additional discussion follows. There are other discrepancies. For example, the inventory occassionally groups multiple units into a single line. This can result in the appearance of a single "large" source when the emissions are associated with a few or many units (e.g., grouping of twelve units at a Maryland facility). The MARAMA inventory typically identifies these groupings in the "Process Description" field which provides the ability for OTC to make inventory corrections. At this time, INGAA does not plan to provide specific recommendations for inventory corrections because the cost of organizing and presenting these data is not trivial and will not result in substantive inventory changes. Individual companies may provide recommendations specific to their facilities.

Controlled Equipment and Size and Utilization Implications

INGAA compiled data from the six primary natural gas pipeline companies operating in the OTR. Three Equitrans facilities are not included, neither are Iroquois Pipeline facilities, although information on the latter is available on-line and indicates low emitting turbines are used as prime movers. In addition to identifying control status, capacity (horsepower) data, and utilization are also being reviewed. This review indicates that:

- Most prime movers are already controlled.
  - For retrofit control of reciprocating engines, NOx is typically marginally higher that the Model Rule limits (e.g., less than 2 to 4 g/bhp-hr) but likely achieves 80% reduction on average. For newer engines installed as controlled units, emissions are typically 1 g/bhp-hr or lower;
  - For retrofit control of turbines, NOx is typically 42 ppmv (at 15% O_2). NOx for newer units installed with NOx control is typically 25 ppmv. Since turbines have lower inherent emissions, an 80% reduction target (from uncontrolled) is not achieved, but reductions relative to a 150 ppmv uncontrolled baseline are about 70% for retrofit control and over 80% for new, controlled turbines.
- When capacity is considered, a higher percentage is controlled; and

- When operations are considered (i.e., horsepower-hours) the control percentage further increases.

Or, to summarize, the vast majority of capacity is controlled and larger, more highly utilized units are more likely to be controlled. Thus, where uncontrolled capacity exists, it is more likely concentrated among smaller units and/or lower use units. Some specific statistics follow based on an initial review of the data:

- Prime movers for the six natural gas pipeline companies include 172 turbines.
  - Over a quarter of the turbines are very small, 1000 hp Solar Saturn units. Records show these units typically have very low utilization and other regulations demonstrate that technologically feasible retrofit NOx control is not available for these units. Even if technology was available, the costs and minor emission reductions would result in control cost effectiveness that far exceed a reasonable threshold.
  - Of the remaining 124 turbines, 77 (62%) are controlled and 47 are uncontrolled. Controlled NOx is typically either 42 ppmv (for retrofit control) or 25 ppmv (for newer units installed with NOx control).
  - An additional 30 turbines are small units between 3000 and 6050 hp. In general, these units exhibit low utilization and control technology is typically not available (Several Solar turbines in this size range may have a retrofit package available but the majority of units do not).
  - The remaining balance is 17 uncontrolled turbines across the region. Utilization varies for these units, and some units have proven retrofit NOx control technology available while others do not. Thus, case-specific alternative RACT would be appropriate for some of these units.
- Prime movers for the six natural gas pipeline companies include 505 reciprocating engines.
  - As discussed below, low emission combustion (LEC) technology for compressor engines can achieve, on average, approximately 3 g/bhp-hr and 80% reduction from uncontrolled levels. Of the 505 engines, there are 335 "highly controlled" units with NOx less than 4 g/bhp-hr and typically less than 3 g/bhp-hr. There are an additional 79 units with mid-level NOx controls and emissions between approximately 4 and 9 g/bhp-hr (e.g., smaller Ajax engines are prevalent in this group). 91 units are uncontrolled. Thus, 82% of the units are controlled (and 66% highly controlled) with 18% uncontrolled based on unit counts.
  - When considering capacity, the control percentage increases. For these 505 units, while 82% of the reciprocating engines are controlled, 85% of the hp capacity is controlled.
    - When comparing units counts and capacity of "highly controlled" engines, a higher relative percentage of capacity is "highly controlled" because the "mid-level" controlled units include many smaller Ajax engines (i.e., highly controlled engines are typically larger engines and mid-level controlled controlled engines are tpyically smaller engines).
  - As discussed below, many prime movers have lower utilization and average estimated systemwide utilization is approximately 40%. The extra capacity is required to address

higher demand days during the heating season. For one of the six companies, the affect of utilization was also examined. For that company, 67% of the units were controlled based on count, 85% of the horsepower capacity was controlled, and 90% of 2007 operations (horsepower-hours) were controlled.

- In general for all six pipeline companies, larger higher use units are more likely to be controlled, and similar trends are evident for all six of the companies.
- Although the specific average utilization was not calculated, ozone season utilization was typically lower for most prime movers. This is expected since utilization is typically higher during the heating season.
- In addition, although OTC presentations have noted concerns about increased natural gas usage, trends over the last few years indicate relatively constant gas demand (e.g., DOE-EIA data can be provided if needed), and marginal increases in electric utitlity use has been offset by lower use for industrial and other sources

- Of the 91 uncontrolled units, the 2010 RICE NESHAP requires NSCR control with collateral NOx control benefits for 28 rich burn engines. This controlled equipment is not factored into the discussion above. If these units are considered controlled, then 87.5% of the reciprocating engine prime movers include NOx control and the associated controlled hp capacity approaches 90%.

Collectively, these data indicate that the vast majority of emissions are controlled and significant reductions have already been realized in the OTR for natural gas prime movers. A presumption that meaningful reductions are available is flawed and should be reconsidered based on a review of the data. If needed, INGAA can provide additional details on natural gas transmission prime movers and NOx controls in the OTR.

Implementation Implications

If the Model Rule results in state regulations, INGAA is concerned that a primary outcome would be significant burden associated with "alternative RACT" requests. Most controlled units are not permitted at levels that meet the Model Rule emission standards, although in some cases actual emissions lower than the proposed limits have been demonstrated. Pursuing incremental reductions will not provide meaningful benefit and is unlikely to withstand a feasibility (i.e., cost effectiveness) analysis. For example, if a reciprocating engine is currently permitted at 3 g/bhp-hr and has demonstrated emissions of 2 g/bhp-hr, incremental reductions (if achievable) to achieve a 1.5 g/bhp-hr emission limit would prove inordinately expensive. Or, the operator would need to conduct analysis to demonstrate that a percent reduction or emissions averaging target is achieved as part of the compliance plan. The costs and ongoing documentation associated with these exercises are not trivial and place undue burden on the permitting agency as well. These implementation issues should be thoroughly considered when evaluating whether Model Rule development should proceed.

2. **Emission limits are overly stringent and should properly consider proven technology performance for *retrofit* control of existing units. Recent NSPS considered implications of retrofit technology, and NSPS limits are appropriate for the Model Rule. In addition, an 80% NOx reduction target is reasonable for reciprocating engines, but a lower threshold is appropriate for turbines, which have inherently lower baseline emissions.**

The basis for the emission standards are unclear, but the Draft OTC White Paper discusses other state regulations and recent federal New Source Performance Standards (NSPS) for spark ignited engines and combustion turbines. The NSPS are 40 CFR Part 60, Subpart JJJJ and Subpart KKKK, respectively. During EPA development of these rules, INGAA provided background information and comments on emissions performance for prime movers and technical limitations associated with retrofit control. As a result, the regulations include marginally higher emission standards for retrofit units as compared to new units, with NOx limits of 3 g/bhp-hr for reciprocating engines and 42 ppmv (at 15% O_2) for turbines larger than 50 MMBtu/hr (approximately 4 MW). Smaller simple cycle turbines for mechanical drive applications such as compressor drivers have higher limits of 150 ppmv.

Reciprocating Engine NOx Emissions

During development of the NOx SIP Call Phase II Rule, which affected large reciprocating engines, EPA reached similar conclusions after an extensive review of the data ï i.e., an emission level *on average* of 3 g/bhp-hr and approximately 80% reduction. Since these rules were developed, signficant advances in emissions control technology have not occurred and these standards remain reasonable limits for existing prime movers that apply proven technology. In addition, since turbine baseline emissions are inherently low when compared to many other types of combustion devices, an 80% reduction target is overly stringent.

For integral reciprocating engines and industrial scale turbines used as prime movers, combustion based controls are used to meet NOx limits. Low emission combustion (LEC) technology for integral engines was developed by the natural gas transmission industry, teaming with specialized service providers, based on a long term, multi-million dollar research and development program to ensure the continued viability of these important assets. Based on that experience, INGAA members have unique experience and understanding of LEC technology. There are unique attributes associated with different makes and models of integral engines, and emissions performance varies. Thus, while some units may be able to achieve the proposed Model Rule standards, others cannot.

EPA, based on its review of integral engines for the NOx SIP Call Phase II Rule, has acknowledged this. EPA analysis for the NOx SIP Call Phase II Rule documented that the large engines targeted by the rule achieved, on average, 3 g/bhp-hr based on approximately 80% reduction from a 16.8 g/bhp-hr uncontrolled baseline. Similarly, Part 60, Subpart JJJJ concluded that a NOx limit for retrofit control (i.e., modified or reconstructed engines) marginally higher than the new unit limit is appropriate. INGAA recommends the following performance levels for the Model Rule:

- An emission standard for reciprocating lean burn engines of 3.0 g/bhp-hr; and,

- An alternate limit for reciprocating engines of 80% reduction based on an uncontrolled baseline of 16.8 g/bhp-hr, manufacturer data, or an uncontrolled level from operator measurements (at the discretion of the operator).

Defining the uncontrolled baseline is necessary because uncontrolled emissions data may not be available for the vast majority of OTC engines that are already controlled. In addition, as discussed in Comment 6, operating load can effect emissions. At reduced load, reciprocating engines should comply with a pounds per hour limit (based on controlled emissions at full load) rather than a 3 g/bhp-hr NOx limit.

Combustion Turbine NOx Emissions

The Model Rule should allow 70% reductions as an alternative to a 42 ppmv limit for larger turbines. Smaller turbines will not provide meaningful reductions and turbines smaller than 5 MW should be excluded from the Model Rule. As discussed below, a turbine threshold marginally higher than the NSPS threshold is warranted because meaningful emission reductions are not available in the OTR from small turbines.

An uncontrolled level of 150 ppmv should be defined as the baseline for turbines, with an emission standard of 42 ppmv or 70% reduction. The record associated with Part 60, Subpart KKKK provides considerable background supporting a 42 ppmv standard for industrial turbines larger than 50 MMBtu/hr based on application of lean premixed (LPM) combustion. For smaller turbines, LPM technology is not available and thus a standard is not supported.

Based on a review of existing prime movers in natural gas transmission, the most prevalent turbine in the OTR is a Solar Saturn. These are very small turbines rated at approximately 1000 hp (or approximately 10 MMBtu/hr). Lean premixed combustors are not an option for these turbines or marginally larger units. In addition, operating records show that the Solar Saturn turbines typically have very low utilization, with 5% to 20% use typical. Thus, the emissions contribution is insignificant. The available data also indicates there are 30 units rated at 3300 hp to 6050 hp (or approximately 5 MW) in the OTR. This size range is the next step up from Solar Saturn turbines. Lean premixed combustors are also not available for most of these units. Establishing an emission standard will undoubtedly result in the need for alternative RACT determinations rather than emission reductions. The 5 MW threshold is marginally higher than the 50 MMBtu/hr threshold in the Turbine NSPS. This threshold is warranted because the units in the OTR population have low utilization (typically less than 20%) and emission control technology is not available. Thus, for turbines, the Model Rule should include:

- An emission standard for turbines of 42 ppmv (at 15% O_2) for turbines larger than 5 MW; and,

- An alternate limit for turbines of 70% reduction based on an uncontrolled baseline of 150 ppmv or an alternative from manufacturer uncontrolled data or source-specific tests.

If smaller turbines are subject to the rule, the proposed 50 ppmv standard cannot be supported because control technology is not available for small existing units and uncontrolled levels are approximately 150 ppmv. In addition, reductions will be trivial and an alternative RACT analysis will likely demonstrate economic infeasibility. Comment 7 provides additional discussion on size thresholds. Comment 6 provides additional discussion on technological issues for NOx control from prime movers. As discussed in Comment 6, the emission limits should apply over reasonable operating loads that differ from the Model Rule proposal of 40 to 100% load. Low ambient temperature also effects emissions performance and Turbine NSPS limits acknowledge this technical limitation.

The emission levels recommended by INGAA are more than appropriate for a regional rule that is intended to extend NOx RACT from areas near a nonattainment area to the entire Ozone Transport Region (OTR). More stringent requirements are not warranted at this time and are not supported by NOx control technologies. If more stringent requirements are included in the Model Rule, the result will be many Alternative RACT determinations.

3. **<u>The Model Rule should include flexible approaches – i.e., emissions averaging should be allowed and a company should be able to apply averaging statewide (i.e., across multiple facilities within the state)</u>.**

As discussed in Comment 6, it is understood that different engines can respond differently to retrofit control. Reductions from baseline uncontrolled NOx levels can be achieved from combustion-based controls, but the emissions endpoint differs for different makes and models of reciprocating engines. EPA and several states have acknowledged this by including emissions averaging in the regulatory scheme. Since the Model Rule would apply statewide as regional reductions are pursued, a company should be allowed to average emissions statewide and define the approach within a Compliance Plan.

Approaches supported by the U.S. EPA for the NOx SIP Call and adopted in other states provide examples. For example, for the NOx SIP Call Phase II Rule, EPA encouraged states to allow owners/operators of large IC engines the flexibility to achieve desired NOx reductions by applying technologies to various sizes and types of reciprocating engines that ultimately achieve an emissions reduction target while accounting for individual engines or models that respond differently to control technology.

It is important to recognize that response to retrofit control technology can vary for different types of engines. A particular model of engines used in natural gas transmission ï Worthington engines ï has a demonstrated history of less effective response to controls. The OTC inventory includes some Worthington engines, including compressor stations with multiple Worthington units co-located at one site. By providing the ability to average reductions across multiple facilities owned and operated by a single company, the Model Rule will provide flexibility while maintaining single party responsibility (i.e., a single company) for emission reductions.

To assist states in implementing the NOx SIP Call Phase II Rule, EPA developed a model rule that includes emission averaging. The Model Rule implements EPA Guidance that was originally expressed in an EPA Guidance Memorandum from Lydia Wegman to regional office Air Division Directors. That memo is provided as an Attachment to these comments. A derivative of the EPA model rule has been included in several state regulations, including the PA DEP regulation that addresses NOx SIP Call Units (25 Pa Code Section 145), and the EPA document is available at: http://www.epa.gov/ttn/oarpg/t1/reports/25546regicenginesfin.pdf . An associated Q&A document is also provided on the EPA website. INGAA and its members were extensively engaged with EPA during that rulemaking and additional details can be provided as needed.

4. A more reasonable schedule is required to implement NOx controls for the fleet of existing prime movers. The proposed schedule is infeasible and could result in reliability problems associated with natural gas delivery to northeastern states.

The implementation dates in the Model Rule are not feasible due to supply and scheduling issues that include technology availability (i.e., vendor supply limitations); integrating downtime into schedules to avoid natural gas service interruption; consideration of budget cycles; and, time necessary to commission and debug the control technology.

As noted previously, many natural gas transmission units have been controlled in recent years, and the operators of affected sources understand the timing necessary for implementing emission controls. With SIP schedules for ozone and $PM_{2.5}$ NAAQS in a state of flux, there is time to devise a reasonable schedule that implements controls in a phased approach beginning in 2015 and giving companies several years to complete the installation of controls across their fleets. .

With compliance testing required by January 1, 2015, the Model Rule requires operational emission controls in 2014. This schedule is simply too aggressive and it is imperative that the OTC consider timing constraints on the industry. For the existing equipment in natural gas transmission, there is a limited community of service providers that support control implementation. Factors to be considered include service provider and equipment availability (which is limited), access to multiple vendors that serve the supply chain, budget cycles and lead time for procuring equipment, consideration of control installation downtime requirements of about one month for each unit serviced, operating constraints that limit out-of-service equipment, and timing for permitting. For example, the Federal Energy Regulatory Commission (FERC) the federal agency that regulates the construction and economics of the interstate natural gas pipeline industry, requires operators to be capable of delivering all of the gas it has been contracted to deliver at all times. Thus, an operator has a very limited amount of flexibility to take critical portions of the system off-line for any significant period of time. A 2014 compliance date would trigger scheduling issues that are insurmountable and would compromise the reliability of natural gas supply.

As an example, LEC installation requires the service of more than one vendor, including the ñprimaryò vendor and associated supply chain support such as turbocharger services. For the large bore, slow speed integral reciprocating engines that comprise the affected OTR capacity, turbocharger installation or upgrade service is available from only two primary suppliers, and manpower scheduling and equipment availability are not trivial issues ï especially if the Model Rule triggers control requirements for engine retrofits in a narrow time window.

For equipment in natural gas transmission, outages are scheduled in late spring to early fall ï i.e., warmer seasonal dates that are not within the winter heating season or shoulder months, and are analogous to the ozone season. Since many units are already controlled, but not to the level in the Model Rule, it is unclear how many units would be affected. However, it is certain that compliance planning, budgeting, and vendor equipment and staffing availability would preclude installation of controls by 2014 for all affected equipment, especially since this is occurring at the same time as RICE NESHAP controls for rich burn engines required by October 2013 under Part 63, Subpart ZZZZ. Forced implementation would conflict with other regulations that affect natural gas transmission, but implementing such a scenario provides no alternative other than removing natural gas transmission prime movers from service during upcoming heating seasons and compromises the reliable delivery of natural gas to consumers which is a direct violation of the FERC requirements.

INGAA recommends an implementation schedule with an initial deadline in 2016 to allow appropriate planning and budgeting, and also recommends a phase-in over several years. The phased-in schedule should consider factors such as size, utilization, and location to identify higher priority units for earlier control with other units addressed over three to five years based on priority (and total counts of affected units).

If needed, additional background information regarding scheduling issues can be provided based on industry experiences complying with state NOx RACT rules and the EPA NOx SIP Call Phase II Rule, including experiences in OTC states.

5. **Compliance monitoring should allow use of portable NOx analyzers. Monitoring should be based on annual tests, allow "skip tests" and/or an operating hours based threshold, and allow testing a subset of multiple similar units at a site. Additional compliance assurance should be achieved based on an operator-defined O&M Plan rather than the multiple plans proposed in the Model Rule.**

The Model Rule should provide additional flexibility regarding test methods and frequency of compliance tests, and also should revise compliance monitoring requirements related to operating and maintenance (O&M) plans. Recent regulations can be referenced for example alternatives.

The proposed Model Rule requires testing twice per year using EPA reference methods. In addition, mutliple operating plans are required. INGAA recommends that the compliance assurance criteria from the recent Spark Ignition Engine NSPS (Part 60, Subpart JJJJ) be reviewed and similar approaches implemented in the Model Rule.

INGAA recommends a test schedule analogous to the engine NSPS (Part 60, Subpart JJJJ), because NOx controls employ combustion-based approaches that are inherent to system operation. Since some units operate sporadically, the test should be based on operating hours rather than a pre-defined schedule. Subpart JJJJ includes a testing requirements of 8760 operating hours but no less frequent than once every three years. That is an appropriate schedule for the Model Rule.

In addition, portable analyzer methods for measuring standard pollutants (e.g., NOx, CO) from natural gas-fired sources have gained acceptance in NSPS and NESHAP regulations for engines, turbines, boilers, etc. Portable analyzer methods should be included in the Model Rule. Finally, the operating conditions associated with testing should be consistent with criteria and issues discussed in Comment 6.

Additional compliance assurance is provided by O&M plans. Sections 8.1 and 8.2 of the Model Rule require an inspection and maintenance plan and operating practices and procedures, respectively. A single operator-defined O&M plan should be sufficient and is appropriate. As an example, reference Part 60, Subpart JJJJ. Especially for existing infrastructure, it is important to base the plan on operator-defined requirements because manufacturer requirements or specifications are not appropriate or available in many cases for existing integral engines. INGAA provided significant comments to EPA during Subpart JJJJ development and can provide those comments to the OTC, if needed to provide additional explanation. To address this issue, INGAA recommends combining Sections 8.1 and 8.2 into a single section that requires an operator-defined O&M Plan, with associated recordkeeping to ensure that the plan is implemented.

6. The Model Rule should more appropriately consider technology limitations for retrofit application of emission controls to natural gas transmission prime movers. These limitations have implications for the emission standards at reduced load and applicable *proven* technology.

Emissions performance and appropriate emission standards are discussed in Comment 2. Additional discussion on emissions performance issues are discussed here, including selective catalytic reduction (SCR) technology which has not been applied to existing prime movers and should not be considered a proven technology for pipeline compressor drivers. In addition to these comments, INGAA can provide additional background on emission technologies for prime movers as needed.

Operating load and low ambient temperature effect emissions performance

Prime movers require flexibility to respond to constant changes in natural gas demand, and the need for operational flexibility is why integral reciprocating engines remain a preferred compressor driver on many systems. These units are designed specifically to compress natural gas and provide enhanced operability, reliability, and efficiency across a wide load range. Operating conditions affect emissions performance and must be considered in the Model Rule, including the applicable compliance test load range of 40% to 100% as indicated in Model Rule Section 6.3.5.

- To ensure flame stability at lower loads for turbines, lean premixed combustion is supplemented with additional pilot fuel as load decreases. Thus, emissions will begin to increase as load decreases and a 40% load threshold is too low because the turbine will begin to migrate out of low NOx mode at a nominally higher load. The specifics for a particular make and model will be provided in the manufacturer guarantee, but a threshold of 70% or higher is more appropriate. The Turbine NSPS, Subpart KKKK, includes a threshold of 75% load and INGAA recommends testing at 75% to 100% load for turbines. For natural gas transmission, this is typically the load range for turbines.
- For reciprocating engines with LEC, emission rates (e.g., emission factors in g/bhp-hr) may vary as load decreases, while mass emissions to the atmosphere remain at or below full load levels. Thus, for reduced load, INGAA recommends that the emission standard for reciprocating engines be based on the equivalent mass emissions at full load (i.e., in pounds per hour based on the allowed emission rate).

In addition, lean premixed combustion technology performance for turbines is affected at very low ambient temperature because increased pilot fuel is required to ensure flame stability. The Turbine NSPS (Part 60, Subpart KKKK) addresses this technical limitation, and NOx limits do not apply when the ambient temperature is 0 ^{o}F or lower. The Model Rule should include a similar limitation and the compliance test should not be conducted when the ambient temperature is 0 ^{o}F or lower.

Technical feasibility of SCR

Prime movers currently use low emission combustion-based technology to reduce emissions. This technology has been applied to many reciprocating engines and turbines and is a proven technology that provides significant NOx reductions from uncontrolled levels. Combustion based controls prevent NOx formation rather than cleaning up exhaust emissions, and LEC for reciprocating engines and lean premixed combustion for turbines have a proven record and an established knowledge base within the natural gas transmission industry. Combustion-based technologies offer significant NOx reductions from uncontrolled emission levels and are as effective, or more effective, than the projected performance from hypothetical application of SCR to existing prime movers.

There are important questions about the technical feasibility of applying SCR to existing natural gas-fired reciprocating engines in natural gas transmission, and it is our industry's experience that technology vendors failed to consider sector specific operating and equipment issues in adapting SCR systems from other applications. In addition, documentation from EPA indicates that there are issues associated with the application of SCR to compressor drivers used in natural gas transmission. EPA statements are associated with control technology assessment for the NOx SIP Call, and in the AP-42 document for IC engines.

For the spark ignited reciprocating engine NSPS, EPA considered application of SCR for NOx control of lean burn engines and concluded that SCR is not a proven technology. SCR has not been retrofit to gas transmission prime movers because of multiple issues and limitations.

Regarding engines affected by the NOx SIP Call, EPA states:

> ñé these engines (lean-burn IC engines in natural gas transmission) experience frequently changing load conditions which make application of SCR infeasibleé our 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.ò (67 FR 8411)

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:

> ñFor 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.ò

While some may argue that technology has evolved in recent years, it is not apparent that engineered solutions have been considered for the unique attributes of gas transmission operations. In addition to operational issues, system designs need to consider that many compressor stations are not manned at all times. Thus, technicians and site technical staff will not be available to attend to issues that can develop for an exhaust control technology that requires active reagent federate control to ensure proper operation. Combustion-based control currently used to reduce prime mover NOx emissions is inherent to system operation, prevents NOx formation, and is better suited for unmanned operations.l

Ammonia slip and other deleterious impacts associated with SCR need to be considered. In attempting to adapt SCR to prime movers, technology vendors have introduced system changes, likely driven by cost and ammonia transportation concerns, for adapting the technology to smaller industrial applications. Two primary changes are use of urea rather than ammonia as the active reagent, and use of predictive algorithms or streamlined measurement-based feedback control loops (e.g., intermittent sampling using technology not intended for continuous measurement) to modulate ammonia (or urea) feedrate in place of a more sophisticated and costly continuous measurement feedback control system. This may address concerns regarding the use and proliferation of anhydrous ammonia, but SCR that uses urea as an alternative to ammonia may result in the formation of undesirable byproduct emissions (analogous to ñammonia slipò but potentially including additional species) or introduce operational challenges (i.e., ensuring urea flow at cooler temperatures for unmanned operations). There is no evidence that SCR vendors have adequately addressed these issues. For example, an understanding of urea decomposition byproducts (other than ammonia) and potential byproducts from urea reaction with exhaust NOx identifies additional by-products that can "slip" past the catalyst but vendors have not attempted to measure these constituents (or at least published any results in the literature).

It does not appear that the SCR vendors have properly characterized control systems and performance issues for application to engines used in natural gas transmission and it is not apparent that predictive control systems can adequately maintain the reagent flowrate within the narrow band necessary to ensure acceptable performance. A technology demonstration would be necessary over an extended period to ensure that the predictive algorithm is adequate. Issues specific to exhaust characteristics for prime movers include engine operating profile, engine wear, variable NO to NO_2 ratios for LEC equipped engines (which affects reagent feedrate demand), and ambient conditions (temperature, humidity, precipitation). The inability of predictive control algorithms to properly maintain reagent feedrate over the very narrow required window (i.e., a reagent to NOx nitrogen molar ratio of approximately 0.9 to 1.1), or an algorithm that is not robust enough to overcome the inherent process time lag to administer flowrate adjustments, can result in dramatic deviations in system performance. Inadequate reagent flowrate control will result in either NOx emission increases, or an increase in the ñslipò of reagent byproducts that include ammonia and other nitrogen species.

Note that the natural gas industry previously conducted considerable research on NOx ñpredictive emission monitorsò (PEMS) with mixed results. PEMS are the analogue to algorithm based SCR-control. The industry research focused primarily on developing systems for existing engines and that practical experience indicated that the ability to develop robust algorithms is problematic, especially when the load changes. This is exactly the attribute required for reagent control. For example, while a system may be able to provide a reasonable prediction of emissions over a longer time scale at relatively stable operating conditions, the moment-to-moment accuracy needed for reagent feedrate control presents a significant engineering challenge. One vendor in the international market utilizing a ñpredictiveò based reagent feedrate control system recognized system performance problems and initiated an effort to develop an ammonia monitor to improve performance.

In total, questions regarding the operating load profile, lack of retrofit application to natural gas operations, and technical issues with SCR adaptation to natural gas transmission applications indicate that SCR has not been demonstrated and should not be considered a viable or proven technology at this time. In addition, consideration of SCR should assess costs and potential disbenefits (e.g., ammonia emissions, transporting ammonia to remote locations, costs and demands associated with catalyst development, cleaning and disposal) relative to the marginal incremental NOx reductions that may be realized from inherently low emitting turbines or LEC-equipped engines.

7. **Higher size thresholds are warranted. INGAA recommends 1000 hp or higher for reciprocating engines and 5 MW (6700 hp) for turbines. These thresholds consider the population of equipment, controls from other standards (i.e., NESHAP controls for rich burn engines 1000 hp and smaller), and technology limitations. In addition, a higher use threshold should be considered.**

As discussed in Comment 2, INGAA recommends an applicability threshold of 5 MW for turbines. Smaller turbines should not be included in the Model Rule because emission reduction technology is not available and NOx reductions cannot be realized from the population of compressor station turbines in the OTR. Instead, operators and permitting agencies would be forced to spend precious resources documenting alternative RACT determinations.

For reciprocating engines, the 200 hp threshold is surprising in a rule intended to address prime movers. By definition, a prime mover is a compressor driver on a interstate or instrastate natural gas transmission pipeline. In general, these engines are larger and range from approximately 1000 hp to over 8000 hp. Due to unique attributes in Pennsylvania, there are some smaller engines within the gas transmission segment in that state. However, most of those units are either already controlled or are required to install controls to comply with the 2010 RICE NESHAP. That rule amended the NESHAP to address existing engines at major and area sources and includes control requirements (i.e., NSCR control) for rich burn engines. In general, engines larger than 1000 hp are typically lean burn engines and engines smaller than 750 hp are typically rich burn engines, with the transition including both types. Available data indicates that with a size threshold of 1000 hp, many of the smaller engines would be captured by the RICE NESHAP. As discussed in Comment 1, minimal reductions appear to be available under any scenario, but based on RICE NESHAP criteria and typical prime movers, a reciprocating engine threshold of 1000 hp or higher is appropriate. If the OTC is intending to capture engines used in upstream gathering or production, then smaller engines may be of interest, but that is not the intent of this Model Rule, and those sources should be addressed in a separate action.

INGAA also recommends that the Model Rule consider an operating-based exemption of 1314 hours (i.e., 15% utilization) rather than the 438 hours (i.e., 5% utilization) proposed in Model Rule Section 7.1. It appears that the proposed exemption is based on allocations similar to emergency engines. However, the Model Rule addresseses prime movers, where capacity requirements to meet high demand days combines with operational practices to ensure equipment is exercised result in many units with annual utilization less than 20%. Meaningful emission reductions will not be gained from these units and a 15% threshold is more appropriate for a prime mover regulation. This approach would also mimic "horsepower-hour" based exemption thresholds that have been included in a recent midwestern state RACT rule.

8. <u>"Nameplate" rating is an ambiguous term. Based on examples from other regulations, unit capacity for determining applicability should be based on "ISO" standard conditions for turbines and "site rated" capacity for reciprocating engines</u>.

The Model Rule uses the "nameplate" rating to define unit capacity, but that is an ambiguous term. For example, some engines can have multiple ratings dependent upon site specific conditions. Established standards should be used to define capacity, and terminology from EPA regulations should be referenced.

For turbines, a standard condition is well-defined and established for unit rating. "ISO conditions" are accepted as the standard for reporting turbine capacity. The term is defined in the Turbine NSPS (40 CFR, Part 60, Subpart KKKK):

> "*ISO conditions* means 288 Kelvin, 60 percent relative humidity and 101.3 kilopascals pressure."

For reciprocating engines, there is not an analogous consistent ñstandardò used to define horsepower, especially when considering the population of existing equipment. Some nameplates can include more than one ñratedò hp ï e.g., differences depending upon the ambient temperature. Factors such as site elevation, ambient temperature, and humidity can impact available horsepower, and this may not be consistently reflected in the nameplate rating for different engines. For example, at lower temperatures (e.g., winter) combustion units can typically produce a higher peak load than when the ambient temperature is higher (e.g., summer). This is commonly understood based on the physics of combustion.

This situation was addressed during development of the engine NESHAP, and EPA chose the following definition based on "site rated horsepower" in 40 CFR, Part 63, Subpart ZZZZ:

> "*Site-rated HP* means the maximum manufacturerôs design capacity at engine site conditions."

To avoid ambiguity and confusion for defining the capacity of existing units affected by the Model Rule, the terminology above should be used for defining rated capacity.

9. The temporary replacement provisions should clearly indicate its applicability to replacement of an entire unit and not sub-components that may be associated with routine maintenance

The temporary replacement provision in Model Rule Section 8.3 should only apply to replacement of the entire unit, including the driver and compressor. INGAA expects that this provision is intended to address small units that can be easily moved or relocated. However, the intent is not clear. The rule should clearly indicate that this section does not apply to partial or component replacement. For example, component replacement is a common maintenance procedure for some equipment, and Model Rule Section 8.3 should not unintentionally affect such long-established maintenance procedures. In addition, the terminology in Section 8.3.1 regarding "similar NOx emissions controls and expected NOx emissions characteristics" should be revised or explained. "Similar NOx emissions" should be an adequate descriptor.

10. Reporting and Recordkeeping requirements should be revised consistent with other recommended changes and to consider Part 70 or Part 71 reporting.

The reporting and recordkeeping requirements in the Model Rule are based on current content, and revisions should be incorporated consistent with other changes. For example, compliance using emissions averaging (as recommend in Comment 3) requires a Compliance Plan and Section 9 of the Model Rule should define the content of that plan and associated reporting. Similarly, based on Comment 5, a single operator-defined O&M Plan should be required and revisions to sections 8.1 and 8.2 should reflect the appropriate records required. Other changes may also be warranted and Section 9 should be reconciled with Model Rule revisions.

In addition, Section 9.3 of the Model Rule prescribes certain annual reporting beginning March 31, 2016, and annually thereafter. Provisions should be included under this Section to allow units that are subject to permitting regulations pursuant to 40 CFR part 70 or 71, and where the permitting authority has established dates for submitting annual compliance reports pursuant to 40 CFR 70.6(c)(5) or 40 CFR 71.6 (c)(5), to submit the first and subsequent annual reports according to the dates the permitting authority has established. It is important to reconcile these dates and allow submittal according to part 70 or part 71 schedules rather than according to the schedule proposed in Section 9.3 of the Model Rule. Similarly, if state schedules have been prescribed for minor sources, that schedule should be allowed rather than the Section 93 schedule.

Based on these comments and through ongoing dialogue with OTC, INGAA hopes that the OTC will reconsider the need for the Model Rule. Alternatively, revisions should be incorporated that result in a rule meeting OTC's objectives while ensuring technically sound regulatory requirements. A clear and effective Model Rule is necessary because this example could proliferate into other areas beyond the northeast states. As discussed in these comments, there is significant information available on combustion-based NOx control for prime movers (e.g., technical support for other recent NOx rules) and significant information available regarding the equipment, utilization, emissions, and NOx control status of prime movers in the OTR. Additional information can be provided to the OTC but significant detail requires more time than the current Model Rule schedule allows.

INGAA appreciates your consideration of these comments and looks forward to your response. Please contact me at 202-216-5935 or lbeal@ingaa.org if you have any questions. Thank you.

Sincerely,

Lisa S Beal

Lisa Beal
Vice President, Environment and Construction Policy
Interstate Natural Gas Association of America

Attachment: EPA Guidance Memorandum, "State Implementation Plan (SIP) Call for Reducing Nitrogen Oxides (NOx) ï Stationary Reciprocating Internal Combustion Engines," August 22, 2002.

cc by email: Ali Mirzakhalili, Delaware NREC
Robert Clausen, Delaware NREC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711
INGAA Attachment

AUG 2 2 2002

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: State Implementation Plan (SIP) Call for Reducing Nitrogen Oxides (NO_x)--Stationary Reciprocating Internal Combustion Engines

FROM: Lydia N. Wegman, Director
Air Quality Strategies and Standards Division

TO: Air Division Director
Regions I-V & VII

The purpose of this memorandum is to provide guidance to States that choose to adopt rules covering stationary reciprocating internal combustion engines (IC engines) as part of their response to the NO_x SIP call. Although the schedule for submittal of the SIPs addressing IC engines under the NO_x SIP call is the subject of on-going rulemaking, I am aware that several States are taking steps toward compliance with the requirements of the SIP call. This memorandum addresses questions on the IC engine source category that have been raised recently by several States as well as by the affected industry in various discussions and meetings. Specifically, EPA is providing guidance on the following issues related to IC engines: State flexibility, periodic monitoring, new source review, and early reductions. The EPA is also clarifying that the guidance in this memorandum reflects EPA's current views and supersede the views underlying the proposed requirements in the Federal implementation plan proposed October 21, 1998 regarding IC engines. This guidance is effective immediately.

State Flexibility

For purposes of complying with the NO_x SIP call, a State is free to choose whatever mix of controls will meet its budget and is free not to regulate IC engines at all. Where States choose to regulate large IC engines, EPA encourages the States to allow owners and operators of large IC engines the flexibility to achieve the NO_x tons/season reductions by selecting from among a variety of technologies or a combination of technologies applied to various sizes and types of IC engines. Flexibility would be helpful as companies take into account that individual engines or engine models may respond differently to control equipment. That is, while certain controls are known to have a specific average control effectiveness for an engine population, some individual engines that install the controls would be expected to be above and some below that average control level, simply because it is an average. Available technologies include combustion modifications, such as pre-combustion chambers or high energy ignition, and post-combustion controls, such as non-selective catalytic reduction.

During the SIP development process the States may establish a NO_x tons/season emissions decrease target for individual companies and then provide the companies with the opportunity to develop a plan that would achieve the needed emissions reductions. The companies may select from a variety of control measures to apply at their various emission units in the State or portion of the State affected under the NO_x SIP call. These control measures would be adopted as part of the SIP and must yield enforceable and demonstrable reductions equal to the NO_x tons/season reductions required by the State. What is important from EPA's perspective is that the State, through a SIP revision, demonstrate that all the control measures contained in the SIP are collectively adequate to provide for compliance with the State's NO_x budget during the 2007 ozone season.

Periodic Monitoring

The NO_x SIP call requires the State to provide for monitoring the status of compliance with any control measures adopted to meet the NO_x budget.[1] Title V air operating permit programs recognize SIP emissions limitations as applicable requirements that must be included in operating permits. Title V permit programs require SIP emissions limitations (and other applicable requirements) in permits to be accompanied by periodic monitoring sufficient to yield reliable data from the relevant time period that is representative of a source's compliance with the emissions limitation. In addition, the compliance assurance monitoring rule[2] may apply to these emissions limitations at certain emissions units at Title V major sources. Acceptable monitoring is not limited to those monitoring methods such as continuous or predictive emissions measurement systems that rely on automated data collection from instruments. Non-automated monitoring may provide a reasonable assurance of compliance for IC engines provided such periodic monitoring is sufficient to yield reliable data for the relevant time periods determined by the emission standard.

Using parametric data may be appropriate, as the source owners and operators in permitting authorities' jurisdiction might already be collecting data that could be used to indicate compliance as part of normal, ongoing operations. When using parametric data to satisfy the periodic monitoring requirement, Title V permits should specify an operating range for each parameter or combination of conditions which will provide a reasonable assurance that the source is in compliance with the underlying requirement. The proposed range should be supported by documentation indicating a site-specific developed relationship between parameter indicator ranges and compliance with the emission limit, although it is not required that the range be set such that an excursion from the range will prove noncompliance with the associated limit. Operational data collected during performance testing is a key element in establishing indicator

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[1]See 40 CFR section 51.121(i).

[2]See 40 CFR part 64.

ranges; however, other relevant information in establishing indicator ranges would be engineering assessments, historical data, and vendor data. The permit should also include some means of periodically verifying the continuing validity of the parameter ranges.

New Source Review (NSR)

Where sources choose to install combustion modification technology to reduce emissions of NO_x at natural gas-fired lean-burn IC engines, EPA believes this action should be considered by permitting authorities for exclusion from major NSR as a pollution control project (PCP). Combustion modification technology for these IC engines is similar to the "low-NO_x burner" technology already listed as a type of project that may be considered for exclusion from major NSR under EPA's PCP exclusion policy.[3] Combustion modification technologies to reduce NO_x emissions at natural gas-fired lean-burn IC engines include, for example, pre-combustion chambers, low emission combustion, high pressure fuel injection, and high energy ignition. It should be noted that, as the air to fuel ratio increases to very lean conditions, carbon monoxide and hydrocarbon emissions may increase slightly as excess air cools combustion temperatures and inhibits complete combustion. Pursuant to EPA's policy, if the source is located in a nonattainment area, the State or the source must provide offsetting emissions reductions for any significant increase in a nonattainment pollutant from the PCP.

Unless information regarding a specific case indicates otherwise, installation of combustion modification technology for the purpose of reducing NO_x emissions at natural gas-fired lean-burn IC engines can be presumed, by its nature, to be environmentally beneficial. This presumption arises from EPA's experience that combustion modification technology is an effective pollution control technology when applied to new and modified natural gas-fired lean-burn IC engines. Therefore, under EPA's PCP exclusion policy, the combustion modification controls may be exempted from NSR provided that the safeguards and procedural steps contained in the exclusion policy memorandum are met.

Early Reductions by IC Engines

For large IC engines, development of the NO_x SIP call budget involved (1) obtaining a 1995 emissions inventory, (2) applying NO_x reasonably available control technology (RACT) controls to major sources in certain areas, including the Ozone Transport Region, (3) projecting emissions to 2007, (4) modifying that subinventory to represent an uncontrolled level of emissions, and (5) calculating a percentage reduction from the uncontrolled 2007 baseline to determine the NO_x tons reduction to include in the States' budget calculations. Because this methodology uses the uncontrolled value, any emission reduction from a large IC engine may be considered for credit toward meeting the NO_x SIP call requirements. Creditable reductions may

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[3]Memorandum from John Seitz to EPA Regional Office Air Directors, "Pollution Control Projects and New Source Review (NSR) Applicability," July 1, 1994.

include emission controls in place during or prior to 1995 as well as after 1995 for the large engines. The applicable control requirements must be adopted as part of the SIP and must yield enforceable and demonstrable reductions.

For smaller IC engines, the first three steps above were completed as part of the NO_x SIP call budget calculation, but the subinventory was not modified to represent an uncontrolled level of emissions, and no percentage reduction was applied to the 2007 baseline in determining the States' budgets. Thus, the 2007 baseline for the smaller IC engines may include controls at IC engines, for example, that were subject to NO_x RACT. Such controls would not be creditable toward meeting the NO_x SIP call reductions because they are part of the 2007 baseline. Where the controls are not part of the 2007 baseline in the NO_x SIP call inventory[4], States may use emission reductions achieved after 1995 at the smaller engines as part of their NO_x SIP call budget demonstration. The applicable control requirements must be adopted as part of the SIP and must yield enforceable and demonstrable reductions.

Federal Implementation Plan (FIP)

On October 21, 1998, EPA proposed FIP requirements for States that failed to meet the NO_x SIP call requirements published on October 27, 1998. In subsequent litigation, the issue of the level of control for IC engines was remanded to EPA. On February 22, 2002 EPA published a proposed rule regarding the NO_x SIP call and level of control for IC engines. The views in the February 22 proposal and in the guidance in this memorandum reflect EPA's current views regarding IC engines and supersede the views underlying the proposed requirements in the FIP with respect to IC engines. For example, although the FIP proposed selective catalytic reduction (SCR) for lean-burn engines, in the February 22 notice we propose there is currently an insufficient basis to identify SCR as a highly cost-effective control technology for lean-burn engines in variable load operations and we propose that low emission combustion technology is a highly cost-effective control technology for the lean-burn engines. As a result, EPA would need to repropose the FIP requirements for IC engines prior to issuing a final FIP concerning the IC engines. A FIP reproposal would need to be consistent with the final rule on the NOx SIP call and control levels for IC engines.

[4]The 2007 baseline NOx SIP Call emission inventory may be downloaded from the following site: ftp://ftp.epa.gov/EmisInventory/NOxSIPCall_Mar2_2000/

Please feel free to contact me or Doug Grano of my staff at (919) 541-3292 if you have any questions or wish to discuss any issues relating to this memorandum.

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Anna Wood, OPAR
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