Interstate Natural Gas Association of America

July 27, 2012

J. Wick Havens
Ozone Transport Commission
Hall of the States, 444 North Capitol Street
Suite 638
Washington, DC 20001

Re: INGAA Comments on the OTC draft document, "Draft Technical Information – Oil and Gas Sector, Significant Stationary Sources of NOx Emissions"

Dear Mr. Havens:

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) draft document, "Draft Technical Information, Oil and Gas Sector Significant Stationary Sources of NOx Emissions". The OTC website also refers to the document as the Draft Oil and Gas Sector TSD (hereinafter referred to as the Draft TSD). The Draft TSD addresses a range of equipment in oil and gas operations, and INGAA comments focus on NOx emissions and emission controls for reciprocating engines and combustion turbines.

INGAA member companies transport more than 85 percent of the nation's natural gas, through some 190,000 miles of interstate natural gas pipelines. INGAA member companies operate over 6,000 stationary natural gas-fired spark ignition reciprocating engines and 1,000 stationary natural gas-fired combustion turbines. These compressor drivers 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 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 SIP requirements related to the ozone NAAQS, and federal NSPS and NESHAPs for spark ignited engines and turbines. These efforts are based on our extensive experience implementing retrofit emission controls for 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 pipeline compressor drivers. Due to INGAA member experience with developing, installing, and operating prime mover retrofit NOx controls, we have a unique understanding of technical issues and limitations associated with NOx control for existing natural gas transmission prime movers.

INGAA appreciates the OTC's receptiveness to our 2011 comments on the compressor station NOx model rule, and appreciates the additional time allowed for submittal of these comments. INGAA welcomes the opportunity to continue to work with the OTC and its Stationary and Area

Source Committee on developing a thorough and accurate technical support document. As detailed in comments below, primary issues of concern regarding the Draft TSD include:

- The Draft TSD should clearly define its objectives, and TSD content should address these objectives. For example, a stated objective is to understand the potential NOx reductions available from the oil and gas sector, but the document presents limited information on the emission inventory, prevalence of controls, and potential reductions. It may be more appropriate to present the document as a compilation of NOx control technology information for equipment used in oil and gas operations.
- Discussions of the equipment and associated emissions should also summarize existing regulations that limit emissions. For example, equipment installed in response to new gas production from the Marcellus shale will typically be subject to federal standards, such as reciprocating engine NSPS and NESHAP rules, and the turbine NSPS. New source review criteria – i.e., BACT or LAER – may also apply in some circumstances.
- The Draft TSD presents a thorough listing of NOx technologies for reciprocating engines and turbines. INGAA recommends that the associated discussion include additional focus on technology issues related to: retrofit versus new unit control; demonstrated performance versus projections from marketing material (e.g., claims of 99% reduction with SCR); and constraints and tradeoffs associated with ultra-low emissions performance targets.

Due to growth in domestic natural gas production and the need for ozone NAAQS attainment SIPs, new rules that consider NOx emissions from natural gas-fired reciprocating engines and turbines are likely in some states and/or regions in the next several years. INGAA believes that the OTC Oil and Gas Sector TSD will serve as a reference document for rulemakings beyond the Ozone Transport Region boundaries. Thus, it is imperative that the TSD provide a factual and reasoned presentation of technical and cost information on control technology, while educating readers on issues such as retrofit control versus new unit performance, demonstrated versus idealistic performance targets, and technology constraints and limitations.

INGAA appreciates your consideration of these comments. 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: INGAA Comments on the OTC Draft OTC Document – "Draft Technical Information, Oil and Gas Sector, Significant Stationary Sources of NOx Emissions"

cc by email: Ali Mirzakhalili (Delaware NREC, OTC Stationary and Area Source Committee)
Robert Clausen (Delaware NREC, OTC Stationary and Area Source Committee)
Joseph Jakuta, OTC
Andy Bodnarik, OTC

ATTACHMENT

INGAA Comments on the Draft OTC Document – "Draft Technical Information, Oil and Gas Sector, Significant Stationary Sources of NOx Emissions"

1. The Draft TSD provides a thorough listing of NOx control technologies. The document should also clearly define its objectives and content should address the objectives.

INGAA commends the OTC for developing a document that provides background on oil and gas industry operations and a thorough list of candidate NOx control technologies. The Draft TSD appropriately includes discussion of technologies, and presents ranges of emissions performance and technology costs. INGAA recommends that the objective of the Draft TSD be clearly stated and consistent with document content.

The introduction (Section 1) of the Draft TSD indicates that the document addresses equipment, emission controls, and example regulations for oil and gas operations. INGAA agrees that the document content is consistent with these criteria. The Draft TSD also indicates that another objective entails understanding the potential for NOx reductions that may be available from the oil and gas sector. However, the Draft TSD presents very little information on actual emissions, the NOx inventory, or the prevalence of controls on current equipment. In several cases, the Draft TSD states that information on NOx emissions and potential reductions is not readily available. If information on the actual NOx inventory, controlled versus uncontrolled sources, and potential reductions (in actual tonnage) is not included in the TSD, then the document should not imply that is an objective. In addition, the Draft TSD indicates that these operations are a significant contributor to air quality concerns. However, this position is not supported and should be deleted.

As discussed in Comment 9, INGAA can provide additional information to assist in developing an accurate accounting of sources, emissions, and control prevalence for units in natural gas transmission and storage. INGAA's September 2011 comments on the Draft NOx Model Rule provided summary information on gas transmission equipment that showed the vast majority of capacity is already controlled. If the Draft TSD is revised to include more details on ozone transport region (OTR) equipment, emissions, controls, and potential reductions, INGAA can provide additional details.

INGAA also recommends that the Draft OTC objective address retrofit control of existing equipment versus new equipment, implications of existing regulations (e.g., federal NSPS and NESHAP standards) that require controls of new units, and implications (e.g., *incremental* costs) of emission targets more stringent than federal rules. By simply listing a range of emission targets, and implying that very low levels are readily achievable, the Draft TSD does not adequately address complicating technological and economic factors associated with emission targets more stringent than federal standards.

In summary, INGAA agrees that the Draft TSD provides a thorough list of candidate NOx emission controls for natural gas operations. However, the document should not indicate that "potential" NOx reductions are significant or refer to resulting air quality impact unless additional information is provided on current emissions, control prevalence, expected inventory growth, and tonnage estimates of feasible emission reductions.

2. **The Draft TSD should present factual information with citations and refrain from conjecture and relying on marketing material. Proper context should be provided for demonstrated technologies and associated performance levels as compared to idealistic claims or marketing projections.**

In the next several years, NOx rulemakings are likely in many states (e.g., NOx RACT rules) in response to ozone NAAQS nonattainment SIP requirements. Thus, the OTC TSD will likely serve as a reference beyond the OTR boundaries. It is imperative that the TSD include accurate information and proper context on emission control applicability. The Draft TSD should not include conjecture. In addition, idealistic or optimistic projections of technology performance, often from vendor's marketing flyers, should be eliminated or include proper context in comparison to demonstrated technologies.

INGAA recommends the elimination of conjecture unless supported by fact. For example, the Draft TSD indicates that equipment from oil and gas operations "collectively emit significant levels of NOx emissions and greatly impact air quality. …that contribute to air quality problems in downwind states." This is a broad ranging conclusion that is not supported. In fact, the Draft TSD frequently acknowledges that emissions and reductions are not known. Suppositions and statements on industry impacts, primarily in Section 2 of the Draft TSD, should be deleted from the Draft TSD unless the conclusions are supported with facts and analysis.

In addition, technology discussions in Section 4 of the Draft TSD should differentiate between demonstrated technologies and idealistic or optimistic projections. Information in the Draft TSD comes from many sources, ranging from peer-reviewed papers to brief on-line summaries or flyers best characterized as vendor marketing material. There should be additional scrutiny of the information sources and the Draft TSD should not treat all material equally. As discussed in comments below, INGAA recommends that the TSD focus on *demonstrated* technologies based on published data and studies; if "other" candidate technologies are included in the TSD, those technologies should be clearly differentiated from proven NOx control technologies. Emission control technologies or performance claims that have not been demonstrated on multiple applications, or are not supported with actual data from oil and gas operations, should not serve as the basis for emission levels presented in the Section 4 summary sections on control performance and costs.

3. **The Draft TSD appropriately notes that unit-to-unit differences can affect NOx control performance and cost, and related information should be included in the technology summary sections. The Draft TSD should be revised to provide additional discussion on factors that affect applicability, performance, and cost.**

INGAA agrees with Draft TSD discussion that acknowledges unit-to-unit differences impact emissions control performance and cost, especially for retrofit control. Emission ranges and cost ranges discussed in the Draft TSD reflect unit-specific issues. Costs are shown as absolute capital costs regardless of equipment size and also scaled as dollars per horsepower (hp). The latter provides a better indication of the range of expected costs, but the NOx control summary sections only present absolute costs. INGAA recommends that summary sections (e.g., section

4.1.5, 4.2.5, etc.) also include costs in dollars per hp and discussion of performance outliers. The emission control sections should also discuss factors that influence unit-specific costs.

INGAA commends the OTC for acknowledging that unit-specific issues affect control performance and cost, noting in the introduction to Section 4.1.3 on combustion modifications that, "… the literature suggests that there are often significant differences in design characteristics between 2SLB engine manufacturers' designs such that applicability and effectiveness of generic NOx combustion controls is highly variable." The Draft TSD cites research related projects for two-stroke lean burn engines. A paper from Cameron indicates low emission combustion retrofit costs ranging from $245 per hp to over $1400 per hp. The same section discusses a Pipeline Research Council International (PRCI) paper and notes that, "… the actual achievable NOx emission rate, in terms of g/bhp-hr, would tend to be engine design specific. Additionally, site specific installation issues may be greatly problematic or not cost effective."

Since unit-specific challenges are a primary issue for applying retrofit NOx control to existing prime movers, INGAA recommends that unit-specific issues for retrofit control be emphasized and reiterated in the summary sections, which present narrower emission ranges (e.g., 3 g/bhp-hr and lower) and absolute costs with narrower ranges than the six-fold cost range based on dollars per hp. The full range of costs and emissions (e.g., some units cannot readily achieve 3 g/bhp-hr) should be included in the summary sections. In addition, the control sections and summary sections should identify factors that influence applicability, performance, and cost, such as:

- Technical challenges such as the "uniflow" design of Worthington two-stroke lean burn engines.
- Lack of sophisticated electronic controls and reliance on mechanical systems (e.g., cam driven) for some existing engines that affect performance or increase retrofit costs.
- Existing systems and upgrades required for NOx control retrofit. For example, existing (typically smaller) lean burn engines without turbochargers may require significant system upgrades for air handling and cooling to implement NOx control, which may significantly impact costs and cost effectiveness (in dollars per ton).
- Since gas transmission and storage facilities often include excess capacity to meet high demand days, some compressor drivers may essentially operate as "peakers" with minimal annual operation. Equipment utilization can significantly affect cost effectiveness based on actual emissions – e.g., cost effectiveness is ten times higher for a unit with 8% utilization compared to a similar unit with 80% utilization.

4. Technology discussion includes details on performance and costs for many control technologies. However, *demonstrated* controls should be the primary focus, and the document should more clearly differentiate between demonstrated control technologies and those that are hypothetical, projected, research targets, or marketing estimates.

Section 4 of the Draft TSD includes a broad discussion of NOx control technologies with details on emissions performance and cost. The Draft TSD cites a range of sources for this information. In some cases, such as PRCI research results and papers presented by established technology service providers, INGAA is well aware of the technology, and its performance and cost. However, there is other information, apparently based on web searches, with claims that are highly suspect, and are likely marketing claims rather than demonstrated technologies with commercial installations.

INGAA recommends additional scrutiny of the technologies listed for compressor drivers, especially when the basis is unsupported claims from on-line material. The TSD should focus on demonstrated technologies, especially when summarizing information on control performance and cost, because some TSD users may focus on the summary sections. In addition, as discussed in Comment 5, the TSD should provide context on emission levels achieved in research programs.

INGAA recommends the categorization of emission controls presented in Section 4 of the Draft TSD based on their current commercial status for oil and gas operations. Demonstrated technologies and performance levels should be the primary focus. INGAA is concerned that the Draft TSD includes claims that are highly suspect – and likely based on marketing material with little detail or support information. Examples of questionable statements on emission controls from the Draft TSD follow:

- The Draft TSD cites a catalyst vendor's website to support a claim of 99% reduction using selective catalytic reduction (SCR). The on-line reference appears to be a marketing flyer. This is clearly not a demonstrated performance level nor a guaranteed emission level.
- A four-stroke lean burn engine technology vendor claims NOx emissions of 0.1 g/bhp-hr using exhaust gas recirculation (EGR). This is a highly questionable claim. Similar "low NOx" claims have been made by control vendors seeking market penetration over the last 15 to 20 years, but INGAA is not aware of any lean burn EGR installations (with complementary NSCR) in operation achieving such low NOx levels. INGAA does not believe that this is a demonstrated technology with commercial applications, and there are obvious complicating factors. For the EGR system to function, a significant recirculation rate would be necessary for a lean burn engine to achieve exhaust oxygen levels that would support NSCR. In addition and as discussed in Comment 6, there are complications and tradeoffs (for emissions and efficiency) when pursuing very low NOx emissions from NSCR control. A system designed for lean burn operation that includes EGR would exacerbate these NSCR technology challenges.

There are additional examples in Section 4 technology discussions. INGAA recommends that information sources be vetted, that demonstrated technologies should be the focus, and that unsupported claims (e.g., claims from on-line marketing flyers) be deleted from the Draft TSD or presented separately and explained.

Similarly, proper context is needed when presenting emission levels associated with research programs, such as the PRCI program cited in Section 4 of the Draft TSD and discussed in the following comment.

5. The Draft TSD should revise or clarify statements regarding technology applicability for two-stroke and four-stroke lean burn engines.

This comment discusses examples where the Draft TSD should be revised or clarified to avoid inappropriate conclusions regarding technology applicability and performance for lean burn engines, especially the slow speed, integral compressor drivers common in natural gas transmission and unique to this industry.

Low Emission Combustion Controls – PRCI Research

Many INGAA members are also PRCI members, and have strongly advocated research on NOx control for natural gas-fired compressor drivers for the last two decades. The PRCI program is the primary driver for technology advancements for low emission combustion (LEC) controls on legacy, slow speed integral compressor drivers. As that program matured, research advanced from first generation LEC controls to more sophisticated and integrated systems. The recent research goal of the program was to develop systems that can achieve NOx levels of 0.5 g/bhp-hr for the most prevalent engine models. The 0.5 g/bhp-hr research emission target is cited in the Draft TSD. INGAA and its members are proud of our industry's commitment to developing and implementing LEC technologies. However, context is important and it should not be presumed that the 0.5 g/bhp-hr research target is generally achievable or indicative of typical performance for retrofit LEC control.

The 0.5 g/bhp-hr NOx emission level from the PRCI research program is an optimal target, but that level is not generally indicative of controls installed to date, generally achievable for all equipment, or may require significant investment with costs that exceed reasonable cost thresholds. Both technological and economic factors can influence whether such a low level is appropriate. High incremental cost in pursuit of minor additional reductions can be a logical reason to select a marginally higher emission level. Costs typically escalate and operability issues (e.g., range flexibility, reliability) may arise if very low NOx targets pursued.

For example, a retrofit lean burn engine at 1.5 to 2.0 g/bhp-hr NOx provides >85% reduction relative to an uncontrolled unit. If technically feasible by layering combustion controls (e.g., improved mixing, additional air and cooling), incremental costs to achieve 90 or 95% reduction may significantly impact cost effectiveness – especially when minimal incremental reductions are considered – and may not be warranted. Operability issues, maintenance costs, etc. may also arise. It is important to consider these complications and each case warrants its own analysis. Thus, although the PRCI research program has advanced the state of the art for retrofit LEC, the emissions performance of demonstrated LEC technology is typically marginally higher than the research program goal.

Although not discussed in the Draft TSD, related information from the PRCI paper that presents engine demographics is informative. This shows that the majority of gas transmission reciprocating engines are integral two-stroke lean burn engines.

Selective Catalytic Reduction

INGAA provided significant background on technical challenges associated with SCR in September 2011 comments on the Draft NOx Model Rule. That discussion is not repeated here, and the September 2011 comments should be referenced for additional details. Important observations are provided here regarding Draft TSD content on SCR.

- The Draft TSD does not adequately weigh the lack of demonstrated SCR units in natural gas transmission. There are not examples of retrofit SCR or application to slow speed integral engines, thus SCR is not a demonstrated technology. There are significant hurdles that have not been addressed. A primary example is the lower exhaust temperature for two-stroke lean burn engines, and the lack of a catalyst that performs across the characteristic temperature range for two-stroke engines. This and other technical challenges should not be ignored or an easy resolution presumed.

- The Draft TSD claim that "unit-specific" challenges for SCR are no different than LEC technology challenges. This is not accurate. LEC has been proven on many slow speed integral lean burn engines and the industry has invested tens of millions of dollars in research and development on LEC application for slow speed engines. Significant effort and expense has been devoted to LEC technology because combustion based controls were seen as the technological solution for NOx control from existing slow speed integral lean burn engines. The same is not true for SCR retrofit to slow speed lean burn engines concerning either technology demonstration or R&D investment. In fact, operators have acknowledged that SCR may be viable (e.g., a paper from the 2011 Gas Machinery Research Conference is cited in the Draft TSD), but integrated systems that consider challenges for application to legacy prime movers have not been addressed. It is inappropriate for the Draft TSD to imply that SCR has the same standing as LEC for NOx control from slow speed integral lean burn engines.

6. INGAA agrees that non-selective catalytic reduction (NSCR) technology applies for rich burn engines. The TSD should provide additional discussion on retrofit versus new engine applications, and emissions tradeoffs when pursuing very low NOx emissions.

INGAA agrees that NSCR is the NOx control technology applicable to 4-stroke rich burn engines and that NOx reduction of 90% or greater from uncontrolled emissions is possible. The TSD indicates that very low NOx emissions are possible with NSCR (e.g., 0.2 g/bhp-hr or lower). However, the TSD does not discuss tradeoffs associated with very low NOx targets. Additional discussion should be added on emission and efficiency tradeoffs and operating considerations to achieve very low NOx with NSCR, and implications for new versus retrofit control.

NSCR reduces NOx emissions by operating the rich burn engine with very low excess oxygen where the catalytic chemistry uses NOx as an oxidant (due to the lack of O_2). If enough oxygen is present, NOx reduction will not occur. Thus, a key technology component for NSCR performance is an air to fuel ratio (AFR) controller, including an exhaust "lambda" sensor, that maintains the AFR setpoint over a *very narrow* operating range. To achieve very low NOx, the AFR needs to be more fuel rich, and as the set point gets richer, NOx will trend towards zero. However, under richer conditions other emissions will increase – i.e., CO and hydrocarbons will not be reduced across the catalyst (and catalyst inlet emissions may increase) and significant emissions of ammonia (NH_3) may also occur. The ammonia emissions result from NOx conversion to ammonia (in a fuel rich environment) rather than reduction to molecular nitrogen. In addition, operation at a richer set point has a negative effect on efficiency so fuel consumption will increase.

The TSD should include discussion of emissions and efficiency tradeoffs. For example, a rich burn engine with NSCR permitted at 1.0 g/bhp-hr NOx (i.e., >90% reduction from uncontrolled levels) that also reduces CO and hydrocarbons and emits minimal ammonia, may be preferred to NOx levels of 0.5 g/bhp-hr or lower that result in increased CO, hydrocarbon, and ammonia emissions, and higher fuel use.

The Draft TSD presents marginally different NOx levels for retrofit versus new units, but should include additional discussion of challenges for retrofit control. New engines may be more sophisticated (e.g., electronic controls). Existing engines may be much more simplistic, which can pose additional challenges for achieving very low NOx levels. Information is available in the literature that discusses continuous performance for engines retrofit with NSCR[1]. The DOE sponsored study conducted by Kansas State University monitored retrofit engines and documented significant NOx reductions, but also indicated that continuous performance varies and very low NOx levels are not consistently achieved. In summary, NSCR technical constraints, tradeoffs, and technology limitations should be discussed in more depth in the TSD.

7. For stationary combustion turbines used for compressor drivers, the Turbine NSPS limits for mechanical drive units are still representative of typical demonstrated performance.

Emissions from natural gas turbines are relatively low when compared to other types of combustion equipment. The Draft TSD discussion of emission controls includes lean premixed combustion (also referred to as "dry low NOx" burners), water or steam injection, and SCR. These are appropriate technologies to discuss, but as noted in Comment 8, additional context on limitations and feasibility is warranted. The Draft TSD presents a range of NOx emission levels and includes the emission standards from the Turbine NSPS (40 CFR, Part 60, Subpart KKKK).

Background documents from the Turbine NSPS rulemaking include considerable detail on the technical basis for emission standards and subcategories that consider the application (e.g., electric generating units versus mechanical drive units), size, and new versus retrofit controls. The emission standards from the 2006 rule are still appropriate today because the same technologies apply. The Draft TSD should highlight the NSPS emission levels and subcategories as indicative of *demonstrated* technologies and NOx performance – e.g., a 42 ppmv (at 15% O_2) NOx standard for retrofit natural gas-fired units from 50 to 850 MMBtu/hr and 25 ppmv standard for similar new units.

8. Technology limitations and feasibility for turbines should be highlighted.

The Draft TSD discusses NOx control technology such as water (or steam) injection and SCR for combustion turbines. In addition, the Draft TSD appropriately notes that retrofit low NOx burners are not available for smaller units (e.g., Solar Saturn turbines). The TSD should include additional context for NOx controls other than lean premixed combustion, because technologies other than lean premixed combustion have had very limited or no application to turbines that drive natural gas compressors.

Water injection was a "first generation" NOx control that reduced emissions by cooling combustion temperatures. It requires very clean water to preclude turbine damage and results in increased CO emissions. That technology was been supplanted by "lean premixed" combustion for NOx control. Our understanding is that water/stream injection has not been used for any turbines in the natural gas industry and is not a demonstrated technology for natural gas transmission compressor drivers.

[1] "Final Report: Cost-Effective Reciprocating Engine Emissions Control and Monitoring for E&P Field and Gathering Engines", Kansas State University, DOE Award DE-FC26-02NT15464, November 2011.

As discussed in INGAA's September 2011 comments on the OTC Draft Model Rule, there are technical challenges with applying SCR to natural gas compressor driver turbines. One SCR installation in California resulted in a multi-year program to re-engineer the system, which did not meet emission guarantees and required higher NOx and ammonia slip limits in a revised permit. To our knowledge, there are no other examples of SCR on turbines in natural gas operations. The limited application of SCR and technical challenges (e.g., robust ammonia/urea reagent control for load following applications) should be acknowledged in the TSD, and it should be noted that lean premixed combustion is the only proven technology for natural gas compressor drivers.

9. Attachment 2 lists OTR compressors, but it differs from information in the MARAMA inventory and INGAA records. Information should be reconciled from different sources. INGAA can provide additional information if needed.

Attachment 2 of the Draft TSD includes a list of OTR natural gas compressors based on 2010 FERC data. The 2011 OTC white paper that supplemented the Draft OTC NOx Model Rule included a compressor list and NOx inventory from 2007. INGAA comments on the Model Rule presented a summary of OTR prime movers based on review of INGAA member records. These three sources provide similar information, but differences exist. In addition, as discussed in INGAA's September 2011 comments, the majority of the natural gas transmission compressor drivers already include NOx control, which is not reflected in the Draft TSD. The competing information sources will likely cause confusion. This should be reconciled, and a single complete list of units in natural gas transmission and storage should be developed. INGAA can provide additional information and assistance as needed. In addition, permits within OTC state agencies can provide detailed information on unit counts, emission limits, and NOx control status.

Example information from the three different information sources follows:

- INGAA's 2011 comments indicated 172 turbines and 505 reciprocating engines (677 total).
  - Excluding 48 small (~1000 hp) Solar Saturn turbines, 62% of the turbines and 82% of the reciprocating engines include NOx control.
  - When reciprocating engine unit size (horsepower) is considered, a higher percentage is controlled on a capacity basis.
  - Based on data from two companies, larger controlled units were more likely to be operated than smaller uncontrolled units.
- The MARAMA inventory identified 409 reciprocating engines and 125 turbines (534 total). One reason for the discrepancy relative to the INGAA counts is that some sources in the MARAMA inventory group multiple units – i.e., several turbines or engines at a single site are listed as a single unit. The MARAMA inventory does not indicate control status.
- Attachment 2 of the Draft TSD does not differentiate between reciprocating engines and turbines and summarizes information by facility (i.e., not at the unit level). Based on data compiled from FERC Forms 2 and 2A, there are 721 total units, including compressors driven by electric motors. Attachment 2 also identifies the total site capacity (hp) and total 2010 operating hours. Operating hours data from the FERC forms confirm 2011 INGAA comments that utilization is low for many facilities. Comparison of the Attachment 2 facility

information for several facilities showed accurate unit counts in some cases and discrepancies (e.g., off by a unit or two) in other cases.

As discussed in Comment 1, information is available (from INGAA, FERC forms, emission inventories, state permits) to prepare a complete list of OTR prime movers that includes information on unit counts by type, emission controls, NOx inventory, and utilization. To understand emissions and the potential for emission reductions from transmission and storage sources, a single master list should be developed that includes complete information and reconciles the different information sources discussed above.