WRITTEN STATEMENT
OF THE
MANUFACTURERS OF EMISSION CONTROLS ASSOCIATION
ON THE
U.S. ENVIRONMENTAL PROTECTION AGENCY'S
PROPOSED STANDARDS OF PERFORMANCE FOR STATIONARY SPARK IGNITION INTERNAL COMBUSTION ENGINES AND NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR RECIPROCATING INTERNAL COMBUSTION ENGINES
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The Manufacturers of Emission Controls Association (MECA) is pleased to provide testimony in support of EPA's proposed performance standards for stationary spark ignited internal combustion engines and National Emission Standards for Hazardous Air Pollutants for reciprocating internal combustion engines.

MECA is a non-profit association made up of the world's leading manufacturers of mobile source emission controls. MECA member companies have over 35 years of experience and a proven track record in developing and commercializing exhaust emission control technologies for a wide range of on-road and off-road vehicles and engines, including gasoline, diesel, and alternative-fueled engines. A recent survey of MECA's members revealed that our industry is investing billions of dollars in R & D and capital expenditures to develop, optimize, and commercialize advanced emission control technology to substantially reduce emissions from internal combustion engines of all sizes from small handheld devices to the largest stationary power generators. Once these proposed regulations are adopted, MECA member companies are committed to make the necessary investments to ensure that the emission control technology needed is available.

MECA supports the EPA's proposed rule to reduce emissions of criteria pollutants from new or rebuilt rich burn engines and hazardous air pollutants (HAP) from new or rebuilt stationary engines. We concur with EPA's conclusion that these engine categories are important contributors to ambient air pollution. However, MECA believes that the EPA's proposal misses an important opportunity to reduce criteria and HAP emissions from new lean burn SI engines and HAP from existing SI and CI stationary engines. As part of this testimony, we highlight the shortcomings of this proposal and provide suggestions where EPA could go further to reduce hazardous air pollutants from new and existing stationary IC engines.

DISCUSSION

Nonroad SI engines <25 hp

MECA concurs with EPA that this class of stationary engines should be consistent with the Phase 2 standards for nonroad SI engines as specified in 40 CFR part 90 for Class I and Class II non-handheld engines. The engines used in both stationary and nonroad applications are essentially the same in both their engine design and duty cycle and, therefore, a consistent set of standards makes sense. As EPA considers more stringent standards for nonroad SI engines less than or equal to 25 hp, we support the implementation of the new Phase 3 standards to stationary engines in this power range. When proposing its Phase 3 standards, we strongly urge EPA to harmonize the standards with California ARB's Tier 3 regulations that go into effect January 1, 2007 for Class I and Class II nonroad engines. MECA provided testimony to ARB's waiver request for emission control requirements for small off-road equipment and concurs with both ARB and EPA staff that emission control catalysts can be applied to this class of engines safely and effectively to reach THC + NOx levels as low as 6 g/hp-hr. Catalysts have been incorporated on over 500,000 lawnmowers in Europe since the late 1990s and tens of millions of small engine motorcycles and mopeds worldwide. MECA urges EPA to move forward quickly with issuing their own proposal for Phase 3 standards that is consistent with the emission levels required in California.

Nonroad SI engines 25-50 hp

The technology to reduce emissions from spark-ignited, off-road engines is based on automotive-type three-way catalyst closed-loop technology. This technology has been used on well over 300,000,000 automobiles with outstanding results. Three-way catalysts have also been used effectively on thousands of large, natural gas-fueled, reciprocating engines (so-called rich burn or stoichiometric natural gas engines) used for power production or pumping applications. These same catalyst technologies can be adapted to spark-ignited engines used in off-road mobile sources such as forklift trucks, airport ground support equipment, and portable generators independent of engine displacement. Closed-loop, three-way catalyst-based systems are already being used on these large, spark-ignited, off-road engines to meet EPA's 2004 3.0 g/bhp-hr HC + NOx standard. Closed-loop, three-way catalyst systems will also be the primary technology pathway for meeting EPA's and the ARB 2007 exhaust emission standard of 2.0 g/bhp-hr HC + NOx and the ARB 2010 standard of 0.6 g/bhp-hr HC + NOx. Retrofit kits that include air/fuel control systems along with three-way catalysts have been sold into the LPG-fueled fork lift industry for installation on uncontrolled engines (an LSI application) for nearly 10 years. Two of these systems have been verified in California, one of which can comfortably achieve 1 g/hp-hr HC+NOx, well below the 2.0 g/hp-hr in this proposal. In both new engine and retrofit applications, these closed-loop three-way catalyst systems have shown durable performance in these LSI applications, consistent with the excellent durability record of closed-loop three-way catalyst systems used in automotive applications for more than twenty-five years. EPA can go further with this proposal by following ARB's lead on this category of engines.

For small stationary engines less than 1 liter displacement and engine power between 25-40 hp, it is unclear why EPA chose to exempt this narrow class of engines from the emission standards for stationary LSI gasoline engines > 25 hp and rich burn engines > 25 hp. Instead these engines are allowed to be certified as small nonroad, non-handheld SI engines and allowed to emit 4.5X the HC and NOx as engines with higher power ratings that are above 1000 cc displacement. This same loophole in the nonroad emission standards has already motivated engine manufacturers to develop engines that are just under 1000cc but have power ratings in excess of 25 hp and some as high as 48 hp. These engines are virtually identical to nonroad gasoline engines having greater than 1000 cc displacement and are used in the same applications, such as aerial lifts, generators, and other industrial equipment. We propose that the standards be distinguished solely by the horsepower rating of the engine irrespective of engine displacement.

Stationary, Non-Emergency SI engines and SI Lean-Burn LPG engines >25 hp

For rich burn engines, MECA agrees with EPA's conclusion that non-selective catalytic reduction can be applied to meet the emission standards outlined in the NPRM. However, MECA believes that EPA is missing a significant opportunity to reduce emissions from new natural gas and lean burn engines by not setting standards that would require catalyst controls that are in use today such as oxidation catalysts (OC) and selective catalytic reduction (SCR) catalysts. EPA concludes in the proposal that the cost benefit does not justify putting any catalyst controls on these engines. Oxidation catalysts have been applied to over 250,000 nonroad diesel mobile source applications and hundreds of stationary lean burn SI engines. Over 50,000,000 diesel passenger cars and well over 1.5 million trucks and buses have been equipped with OCs. Oxidation catalysts are extremely effective in achieving 90% reduction of hazardous air pollutants such as HC and CO from lean burn engines. These catalysts also provide significant reductions in toxic emissions by eliminating benzene, formaldehyde, acetaldehyde, methanol and other HAP from the exhaust. Oxidation catalysts have been installed on a limited number of marine diesel applications, a duty cycle that closely mimics stationary operation. We estimate the operating costs of OC, applied to lean burn engines (500 hp) to be around $400/ton (inclusive of catalyst depreciation) of the above pollutants.

SCR technology is a proven NOx control strategy. SCR has been used to control NOx emissions from stationary sources for over 15 years. One manufacturer has installed hundreds of SCR emissions control systems on stationary diesel and natural gas IC engines from 10 MW Detroit Diesel 1635 type installations to several hundred horsepower Cummins 150DGFA engines. The systems have been in continuous operation since the late 1980s, providing >80% NOx reduction. Newer units are providing co-benefits of >90% NOx, >80% CO, and >70% VOC.

Recently, urea-SCR technology has been applied to select mobile sources including trucks, marine vessels, and locomotives. In 2005, SCR using a urea-based reductant has been introduced on a large number of on-road diesel heavy-duty engines to help meet the Euro 4 heavy-duty NOx emission standards. SCR is also being given serious consideration by engine manufacturers for complying with future on-road heavy-duty diesel engine emission standards in both the U.S. and Japan (in the 2009-2010 timeframe). Applying SCR to diesel-powered engines provides simultaneous reductions of NOx, PM, and HC emissions. Since the mid-1990s, SCR technology using a urea-based reductant has been installed on a variety of marine applications in Europe including ferries, cargo vessels, and tugboats with over 200 systems installed on engines ranging from approximately 450 to 10,400 kW. These marine SCR applications include the design and integration of systems on a vessel's main propulsion engines and auxiliary engines. This technology is capable of achieving in excess of 80% NOx conversion efficiency. An SCR system on a 375-500 hp engine can cost $6000/ton of NOx reduced inclusive of catalyst replacement costs (assuming 2800 hrs/yr operation).

MECA agrees with the cost estimates that EPA used in their cost-effectiveness analysis in preparing this rule. However, the final cost benefit analysis and conclusions rely on an estimate of the number of operating hours. EPA assumed a value of 1000 hours/year, which we believe is a significant underestimation. In most cases, our members have reported pump engines and primary gensets operating upwards of 3000 hours and, in some cases, 8000 hours/year. Since the cost benefit analysis and conclusions rely heavily on the operating hours assumed, one can easily overestimate the costs of maintaining the catalyst system on these engines. Furthermore, even a relatively inexpensive oxidation catalyst can provide significant multi-pollutant co-benefits in reducing CO, HC, VOC, and SOF and, therefore, EPA should go further by setting standards that would require emissions controls on all stationary reciprocating internal combustion engines.

Stationary SI Landfill/Digester Gas Engines

The EPA considered this category of stationary engines in their proposal. In their analysis, consideration was given to HAP reduction technology, such as oxidation catalysts. The gases used to operate these engines may contain compounds, such as siloxanes, that may poison catalysts and limit their life. Therefore, the final standards were set to levels that could be achieved by engine modifications or on engine controls. Technology is available for handling siloxanes and cleaning the digester and landfill gases. At least one manufacturer has installed 80-100 commercial systems around the world over the past 10 years specifically for the clean-up of siloxanes. Many of these systems have been installed in conjunction with emission control devices allowing the use of catalysts on systems as large as 28 MW. With energy sustainability becoming a significant priority by the U.S. government and of increasing interest among the general public, this type of fuel represents a renewable fuel source. In a supportive regulatory environment, new technologies are likely to develop and grow and facilitate the use of add-on emission controls on this category of engines. MECA believes that the EPA should seize the opportunity and set future standards to clean up these engines with existing, inexpensive oxidation catalysts.

National Emission Standards for Hazardous Air Pollutants for Stationary SI and CI Engines

As part of their proposal, EPA has chosen to limit hazardous air pollutants from both spark ignition and compression ignition engines under the reciprocating internal combustion engine (RICE) National Emission Standards for Hazardous Air Pollutants (NESHAP). HAP emissions are known to contribute significantly to air pollution which can endanger public health and welfare. MECA believes that the current proposal does not go far enough to limit HAP from new lean burn or existing SI and CI engines by not requiring emission control devices. We believe that the EPA is missing an important opportunity to make a significant impact to the emissions inventory from existing stationary engines by requiring the application of emission controls, similar to those that are common today on mobile sources. Tens of millions of DOCs have been installed on new diesel engine applications. These catalysts represent some of the most cost-effective and maintenance-free technologies available for retrofit on even the oldest engines. We have discussed the application of these catalysts on new lean burn engines above; however, the same types of catalysts have been successfully retrofit to existing off-road and stationary engines.

For stationary lean burn and diesel (CI) engines, the application of DOCs is limited; however, the technology has been applied to some large, stationary diesel engines. An example of this is the installation of DOCs on an emergency generator in California in 2000. The engine is a Cummins KTA50-G9 rated at 1,650 kW. The DOC installed on this large diesel engine provides odor control as well as reducing PM, CO, and hydrocarbon emissions. Several other DOC installations on stationary engines or tests of DOCs on stationary engines are listed in the ARB staff stationary engine report available at: www.arb.ca.gov/regact/statde/statde.htm. Oxidation catalysts have also been installed on ferries operating around Hong Kong and have been effective in reducing particulate emissions.

EPA's proposal has suggested that the retrofit of catalyzed diesel particulate filters to stationary CI engines is not cost-effective. There is a wealth of experience where catalyzed diesel particulate filters (CDPFs) have been installed on both on- and off-road in-use vehicles. Over 200,000 on-road heavy-duty vehicles worldwide have been retrofit with CDPFs and over two million new diesel passenger cars in Europe have been equipped with this technology since 2000. In North America, CDPFs will become standard equipment on new U.S. highway heavy-duty diesel engines starting in 2007 (to meet EPA's 2007 highway heavy-duty engine particulate standard of 0.01 g/bhp-hr).

For nonroad engines, CDPFs have been successfully installed and used on mining, construction, and materials handling equipment where vehicle integration has been challenging. These nonroad applications include the use of both passive and active filter regeneration strategies. Active nonroad DPF options include diesel fuel injection strategies, engine throttling strategies, the use of electrical heating elements, and fuel burners. Over 20,000 active and passive systems have been installed on nonroad applications as either original equipment or as a retrofit worldwide. Some nonroad filter systems have been operated for over 15,000 hours or over five years and are still in use.

Particulate filters, many employing active regeneration strategies such as fuel burners or electrical resistance heaters, have also been used on over 100 locomotives in Europe since the mid-1990s, providing in excess of an 85 percent reduction in particulate matter (PM) emissions. Some of these systems have been operating effectively for over 650,000 kilometers.

Large stationary diesel engines used for both primary and back-up power generation have also been installed with CDPF systems to control particulate emissions. Perhaps the most comprehensive information on the application of CDPFs to stationary diesel engines can be found in the California Air Resources Board staff report referenced previously. This report includes lists of CDPF applications and reports on operating experience on large stationary engines in California. The California experience includes numerous DPF installations on large engines rated above 600 kW, including Caterpillar 3516 engines rated in the 1490-2120 kW range. Operating experience with these large engine DPF systems has been generally good with DPFs providing 85% or larger reductions in particulate matter compared to uncontrolled levels. More recently, in July 2005, the California Energy Commission published a report detailing the emission performance of back-up diesel generators with a variety of power ratings equipped with exhaust emission controls including DOCs, passive DPFs, and active DPFs (this report is available at: www.energy.ca.gov/pier/final_project_reports/CEC-500-2005-049.html). The DPFs evaluated in this program were again found effective in reducing PM emissions by more than 85% compared to uncontrolled baseline levels. Currently several manufacturers have been verified under ARB's diesel retrofit verification program with DPF technology for stationary diesel engines. These DPF technologies have been verified as Level 3 technologies (>85% particulate matter reduction) for a wide range of diesel engines used in stationary applications.

Additional verifications of retrofit DPF technologies for stationary engines are expected under this ARB program.

The California ARB has conducted a cost-effectiveness analysis for retrofitting CDPFs to stationary CI engines as part of their 2003 Air Toxics Control Measure and concluded that the cost justified requiring retrofit for these engines in California. ARB's argument was based primarily on the reduction of diesel particulate matter (PM). Although diesel PM is not included on the list of HAP compounds, it is known that diesel PM has negative health impacts and is considered a suspected carcinogen by the EPA. Furthermore, approximately 30% of diesel PM is made up of soluble organic fraction (SOF). The SOF consists of condensed volatile compounds, many of which are on the HAP list. A relatively simple device such as an oxidation catalyst can effectively remove the SOF from the carbon particles, offering significant HAP benefits at a reasonable cost.

It is important to consider the multi-pollutant co-benefits that even a simple oxidation catalyst can provide in reducing, CO, HC, VOC, and SOF. We also note, however, that the experience with cost estimations for compliance with other categories of engines often proves to be less than the estimates at the time of the original proposal as regulations help to establish new markets and facilitate competition.

CONCLUSION

In closing, we support, in general, the proposed regulations and recognize that they are an important first step in reducing emissions from stationary SI and CI engines. We hope that EPA reviews the recommendations laid out in this testimony and seizes the opportunity to go beyond what has been originally proposed to reduce hazardous air pollutants. We believe that EPA should strengthen its proposal by adopting final standards that are based on a systems approach similar to their mobile emissions programs; combining engine design improvements, catalyst-based emissions control systems, and low sulfur fuel. As stated above, catalyst systems have been used on mobile on-road and off-road engines for over 35 years. The same emission control technologies have been successfully applied to new and existing stationary engines by our members for many years. By strengthening its proposed NESHAP standards for existing engines based on emission levels achievable with advanced catalyst technology, EPA will carry out the mandate of the Clean Air Act and will ensure that emissions reductions needed to help protect the public health are achieved. If EPA finalizes the standards as proposed, we believe an important opportunity to achieve significant emissions reductions will be lost for years to come. We look forward to working with EPA, the engine and equipment manufacturers, end-users, and others in finalizing this rule.