

**Statement
of the
Manufacturers of Emission Controls Association
on the California State Nonroad Engine Pollution Control Standards;
California Nonroad Compression Ignition Engines – In-Use Fleets; Authorization Request**

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The Manufacturers of Emission Controls Association (MECA) is pleased to provide comments in support of the Air Resources Board's (ARB) waiver request for California's regulation of in-use fleets that operate nonroad, diesel-fueled equipment with engines 25 horsepower and greater. Over the past three decades, ARB has shown leadership in its continuing efforts to develop and implement effective air pollution control programs for mobile sources. We believe that ARB's emission standards for nonroad, compression-ignition in-use vehicles present a balanced, fair, and flexible approach that will achieve significant particulate matter (PM) and nitrogen oxide (NOx) emission reductions in a cost-effective manner. MECA believes it is important that EPA grant California a waiver for its efforts to control emissions from these in-use nonroad diesel vehicles.

MECA is a non-profit association of the world's leading manufacturers of emission control technology for motor vehicles. Our members have over 30 years of experience and a proven track record in developing and manufacturing emission control technology for a wide variety of diesel and gasoline on-road and off-road vehicles and equipment. A number of our members have extensive experience in the development, manufacture, and application of PM and NOx control retrofit technologies.

Our members have invested and continue to invest significant resources in developing and verifying diesel retrofit technologies for the whole range of in-use diesel engines currently operating in California, including on-road, off-road, and stationary sources. New diesel emission control products continue to be added to ARB's list of verified retrofit technologies. The number of Level 3 VDECS suitable for off-road vehicles has increased over the past two years to a total of 10 verified devices (five passively regenerated Level 3 DPFs and five actively regenerated Level 3 DPFs). Manufacturers are expected to verify even more passive and active filter technologies in the coming year for off-road applications to further expand the options available to fleet owners to comply with ARB's requirements. Several manufacturers are closely engaged in verifying urea-SCR retrofit technology with ARB for both on-road and off-road applications, and these efforts should lead to additional verified NOx retrofit technologies. In addition, manufacturers have made significant investments in re-verifying PM retrofit technologies to comply with ARB's NO₂ requirement. Given the substantial investment in verifying systems and delays in previous in-use fleet regulations, retrofit manufacturers are extremely cautious in making this investment without clear direction in the marketplace. They rely on regulatory stability in order to continue making the necessary investments to meet the commercial needs in time for implementation.

Technologies to Reduce Diesel PM and NOx Emissions

MECA offers some additional comments here regarding the technological feasibility and retrofit experience with emission control technology options available to reduce PM and NOx emissions from existing off-road vehicles to meet diesel emission reduction goals. (Additional information on diesel retrofit technology is available on MECA's diesel retrofit website at: www.dieselretrofit.org.)

Important differences exist between on-road and off-road diesel applications. Although off-road applications will pose engineering challenges and special requirements, the use of exhaust emission control technology for off-road diesel engines is not new. Both PM and NOx control technologies are being demonstrated today on off-road applications in California and elsewhere. For over 30 years, off-road diesel engines used in the construction, mining, and materials handling industries have been equipped with exhaust emission control technology – initially with diesel oxidation catalysts (DOCs) and followed later by diesel particulate filters (DPFs). These systems have been installed on vehicles and equipment both as original equipment and as retrofit technology on over 250,000 nonroad engines worldwide, including construction and mining equipment where vehicle integration has been challenging.

A number of advanced emission control technologies exist today to significantly reduce PM and NOx emissions from off-road diesel engines. These include diesel particulate filters, diesel oxidation catalysts, selective catalytic reduction, NOx adsorbers, lean NOx catalysts, exhaust gas recirculation, and crankcase filters.

Diesel Particulate Filters – Diesel particulate filters (DPFs) are commercially available today. When used in combination with ULSD, high-efficiency DPF technology can reduce PM emissions by up to 90 percent or more, ultra-fine carbon particles by up to 99+ percent, and, depending on the system design, toxic HC emissions by up to 80 percent or more. Over 200,000 on-road heavy-duty vehicles worldwide have been retrofitted with passively or actively regenerated DPFs. In addition, over four million new passenger cars have been equipped with DPFs in Europe since mid-2000, and, since 2007, every new heavy-duty on-road engine sold in the U.S. and Canada has been equipped with a high-efficiency DPF. Significant investments in DPF production capacity have been made and will be expanded in the future to ensure that DPF demands for both new vehicles and retrofit applications in North America can be met.

Local Law 77 in New York City is responsible for putting retrofit devices on a wide variety of city-owned and contracted construction equipment. For example, the Croton Water Treatment Project in North Bronx, NY, successfully installed PM and NOx control devices (including passive and active DPFs) on over 30 pieces of construction equipment, including excavators, bulldozers, backhoes, and cranes. A number of off-road diesel demonstrations have been done in California, such as the runway expansion at LAX airport. These off-road applications include the use of both passive and active filter regeneration strategies. Active off-road DPF options include diesel fuel injection strategies, engine throttling strategies, the use of electrical heating elements, and fuel burners. Over 50,000 active and passive DPF retrofit systems have been installed worldwide on off-road applications.

Flow-through filter technologies are also emerging for diesel retrofit applications. These “partial” filters make use of wire mesh supports or tortuous metal substrates that employ sintered metal sheets. These metal substrates can be catalyzed directly or used in combination with an upstream catalyst to facilitate regeneration of soot deposits. These partial filter designs are less susceptible to plugging and can offer PM reduction efficiencies in the 50-75 percent range depending on engine operating conditions and the soluble fraction of the PM. Some of these partial filter designs have also been shown to operate over long periods of time without the need for ash cleaning associated with engine lubricant consumption.

Development work is underway to further enhance the performance of filter system designs. For example, work continues on developing and implementing additional filter regeneration strategies that will expand the applications for retrofitting DPFs. Development work on filter materials and designs to further enhance filter system durability and to further reduce backpressure are under development. Manufacturers are also developing DPF options that minimize NO₂ emissions in systems that make use of NO₂ for filter regeneration.

Selective Catalytic Reduction – SCR technology is a proven NO_x emission control strategy. SCR technology has been used to control NO_x emissions from stationary sources for over 20 years. More recently, it has been applied to select mobile sources, including trucks, marine vessels, and locomotives. In 2005, SCR using a urea-based reductant was introduced on a large number of on-road diesel heavy-duty engines to help meet the Euro 4 heavy-duty NO_x emission standards. There are now more than 500,000 SCR-equipped trucks operating in Europe. SCR technology is also being used by engine manufacturers to comply with more stringent NO_x standards for on-road heavy-duty diesel engines recently implemented in both the U.S. and Japan. Several auto manufacturers have also developed SCR systems for light-duty diesel vehicles that have begun to be sold in California and across the U.S. Applying SCR technology to diesel-powered engines provides simultaneous reductions of NO_x, PM, and HC emissions.

A number of off-road diesel demonstrations have been done with combination SCR+DPF retrofit systems. For example, an SCR+DPF system was installed on a 170-hp John Deere compressor engine involved in the Croton Water Treatment project in New York City. In California, a 300-ton gantry crane powered by a turbocharged, after-cooled diesel engine rated at 850 kW has been equipped with such a combined emission system. A number of combined SCR+DPF systems have also been installed on stationary diesel engines used for power production, including six Caterpillar 3516B engines operating in southern California.

Lean NO_x Catalyst Technology – ARB has conditionally verified one technology option that combines a lean NO_x catalyst (LNC) with a diesel particulate filter to achieve 40 percent NO_x reduction with Level 3 particulate control for off-road heavy-duty engines. Other technology providers are also in the process of commercializing LNC+DPF systems for a variety of off-road retrofit applications, including construction equipment, agricultural pumps, and portable engines.

Low-Pressure Exhaust Gas Recirculation – This technology is being successfully demonstrated in retrofit applications on trucks, buses, and other applications. Over 2,000 systems are running worldwide. Low-pressure EGR has demonstrated a NO_x control capability in the range of 30 to 60 percent. ARB has currently verified one low-pressure EGR+DPF system with up to 50 percent NO_x reduction for a range of on-road and stationary diesel engines.

Diesel Retrofit Devices and Safety

Proper integration of emission control technology on off-road vehicles and equipment is important for three reasons: 1) to ensure the system is installed at the appropriate place in the exhaust system to optimize effectiveness, 2) to ensure the system physically fits in the available space, and 3) to ensure safety. Over 30 years of experience in integrating emission control technologies on a variety of diesel and spark-ignition off-road vehicles and equipment ranging from <25 hp to over 750 hp provides a clear indication that emission control technology can be successfully integrated on a wide range of off-road vehicles to meet ARB's standards and ensure the safety of the vehicle operator and others. In addition, exhaust emission control technology has been integrated on to vehicles to address special operating concerns and environments. For example, where equipment is used in explosive operating environments, such as underground coal mines, emission control technology has been designed to meet special surface temperature requirements.

An important requirement for installing emission control technology on off-road vehicles is to ensure that the device can withstand the vibration and/or extreme operating conditions associated with the operation. Emission control technology can be designed, installed, and operated to provide effective, reliable, and durable performance under these extreme conditions. This has been demonstrated by the diesel particulate filter systems that have been used in underground mining applications for over 15,000 hours in rugged work environments and continued to provide effective emission reduction performance. A 2003 survey (SAE Paper 2004-01-0076) of 3,848 construction retrofit installations from 2001 to 2003 in Europe found a failure rate of 1-2 percent. The failures were identified as a combination of fuel/lubricant, operator, and product issues, which have been addressed through further product improvements.

Exhaust emission control technologies have been installed on vehicles so as not to impair operator visibility. Safety is an essential component of the engineering and installation of retrofit emission control devices. MECA and our member companies are actively involved with ARB staff to further clarify criteria used in granting exemptions from retrofit requirements for applications or installations deemed to be unsafe. Having a well defined review process in place ensures that implementation of the proposed regulations are accomplished with minimal administrative delays or judgments. We are working with Cal/OSHA, ARB, and interested stakeholders to develop effective and realistic amendments to the California Code of Regulations that will serve to ensure that modifying construction equipment with VDECS is done with consideration to the safe operation of the vehicle, the operators, and workers on construction sites.

To establish safe levels of visibility on construction equipment, international standards like ISO 5006 have recognized that the use of mirrors and CCD cameras can be successfully used on off-road equipment to ensure adequate operator visibility. In many cases, OEM-designed off-road vehicles are equipped with mirrors to allow them to meet minimum visibility requirements. As in the case of OEM installed mufflers, surface temperature issues with retrofits are often addressed by the use of heat shielding in cases where vehicle operators or maintenance personnel may inadvertently come in close proximity to hot surfaces. Surface temperature measurements conducted by MECA members have demonstrated that DPF surface temperatures are no higher than those measured on OEM mufflers and, in some cases, are actually lower.

Conclusion

In closing, we ask EPA to grant ARB a waiver for its innovative In-Use Off-Road Diesel Vehicle Regulation that will significantly reduce PM and NOx emissions from in-use off-road diesel vehicles operating in California. Our industry pledges its continued support and commitment to ensure that retrofit control technologies are available to achieve the desired emission reductions within the time frame specified in the regulation.

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