WRITTEN COMMENTS OF THE MANUFACTURERS OF EMISSION CONTROLS ASSOCIATION ON THE CALIFORNIA AIR RESOURCES BOARD'S PROPOSED LEV III AMENDMENTS TO THE CALIFORNIA GREENHOUSE GAS AND CRITERIA POLLUTANT EXHAUST AND EVAPORATIVE EMISSION STANDARDS AND OBD REQUIREMENTS FOR LIGHT-DUTY/MEDIUM-DUTY VEHICLES AND EVAPORATIVE EMISSION REQUIREMENTS FOR HEAVY-DUTY VEHICLES

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The Manufacturers of Emission Controls Association (MECA) is pleased to provide comments in support of the California Air Resources Board's proposed LEV III amendments to their greenhouse gas and criteria pollutant exhaust and evaporative emission standards and OBD requirements for light-duty/medium-duty vehicles, and evaporative emission requirements for heavy-duty vehicles. These amendments, when adopted, will reset the bar for state-of-the-art exhaust and evaporative emission controls for light-duty vehicles through 2025. MECA applauds ARB for working with EPA on developing a LEV III proposal that will provide the framework for a Tier 3 light-duty proposal that will establish a national set of exhaust and evaporative emission standards for light-duty vehicles. MECA also applauds ARB and EPA for bringing forward a comprehensive and largely harmonized set of proposals covering light-duty vehicle greenhouse gas emissions that will also result in a single national program for reducing the climate impacts of future vehicles.

MECA is a non-profit association of the world's leading manufacturers of emission control technology for mobile sources. Our members have over 40 years of experience and a proven track record in developing and manufacturing emission control technology for a wide variety of on-road and off-road vehicles and equipment, including extensive experience in developing exhaust and evaporative emission controls for gasoline and diesel light-duty vehicles in all world markets. Our industry has played an important role in the emissions success story associated with light-duty vehicles in California, and has continually supported efforts to develop innovative, technology-forcing, emissions programs to deal with California's unique air quality problems.

The experience of our industry over the last 40 years vividly demonstrates the connection between vehicle emission regulation and economic development. Prior to 1970, our industry did not exist. But, with the enactment of the Clean Air Act in 1970, our industry has flourished, developing successive generations of technology to meet ever tightening regulatory standards. Since the introduction of the catalytic converter in 1975, more than 500 million light-duty vehicles have been sold in the United States equipped with exhaust and evaporative emission control technologies developed by our industry. This generated an estimated $250-$300 billion in economic activity since 1975. In 2010 alone, our industry generated $12 billion of economic activity and accounted for 65,000 U.S. jobs, mostly in manufacturing.[1] ARB's proposed LEV III amendments and greenhouse gas emission standards on light-duty vehicles will provide

[1] Manufacturers of Emission Controls Association, "MECA Highlights Economic Benefits of Mobile Source Emissions Control Industry," March 11, 2011 press release (see www.meca.org).

additional support for the continued development of a thriving U.S. industry focused on a wide range of technologies that can reduce vehicle criteria and greenhouse gas emissions.

The majority of MECA's comments address the LEV III exhaust and evaporative emission proposals detailed in the ARB staff Initial Statement of Reasons that was released on December 7, 2011. MECA agrees with ARB staff's assessment that achieving the proposed LEV III exhaust and evaporative emission standards and associated emission reductions are both technically feasible and cost effective. This fact is clearly demonstrated by the more than two million SULEV and PZEV compliant light-duty vehicles that have been sold in the California market since these near-zero emission, gasoline vehicles were first introduced more than ten years ago. The technology base of advanced three-way catalysts, exhaust hydrocarbon adsorber materials, high cell density substrates, emission system thermal management strategies, secondary air injection systems, advanced carbon canisters, advanced low fuel permeation materials, and air intake hydrocarbon adsorber materials that have already been commercialized for PZEV gasoline vehicle applications can be extended to and further optimized to allow all light-duty, medium-duty, and heavy-duty gasoline vehicles to achieve the exhaust and evaporative emission reduction needed by vehicle manufacturers to comply with the LEV III light-duty, medium-duty, and heavy-duty vehicle exhaust and/or evaporative emission proposals put forward by ARB. In addition advanced diesel emission control technologies including diesel particulate filters, lean NOx adsorber catalysts, and selective catalytic reduction catalysts will be combined with future, advanced diesel engines to allow light-duty diesel vehicles to achieve the proposed LEV III emission limits (including ARB's proposed SULEV30 exhaust limits).

MECA agrees with ARB's decision to propose tighter particle matter standards for light-duty vehicles over the FTP test cycle and to establish full useful life PM standards for light-duty vehicles over the supplemental FTP test cycles. However, the recent late December 2011 decision by the European Commission to establish a particle number emission standard for light-duty vehicles powered by gasoline direct injection (GDI) engines as a part of their upcoming Euro 6 light-duty emission standards, provides a more stringent particle emission limit for these GDI vehicles in the same time frame as ARB's proposed 3 mg/mile PM standard (proposed phase-in for the 3 mg/mile PM standard starts in 2017 and is fully phased-in with the 2021 model year; the Euro 6 GDI particle number limit has been set at 6×10^{11} particles/km, measured using the European PMP particle measurement protocol; see: http://circa.europa.eu/Public/irc/enterprise/automotive/library?l=/technical_committee/december_confirmed/text-02122011pdf/_EN_1.0_&a=d.). This European particle number limit will cause auto manufacturers to introduce cleaner technologies such as advanced fuel injection systems and/or gasoline particulate filters to comply with the European Euro 6 GDI particle number limit. Auto manufacturers are already working to bring forward early introductions of these cleaner Euro 6-compliant gasoline engines to the European market in the coming 12 to 18 months (European member states are permitted to introduce tax incentives for early introductions of Euro 6 vehicles prior to the first implementation dates of September 2014 for new models and September 2015 for all passenger car models). Nearly all auto manufacturers that sell into the European market are working with MECA members on potential applications of particulate filters on gasoline direct injection vehicles.

Gasoline particulate filters (GPFs) are based on the same, wall flow ceramic filters that have been successfully applied on millions of light-duty diesel vehicles in Europe and the U.S.

for more than 10 years. The performance and application of these gasoline particulate filters has been highlighted in a number of recent technical publications in both the U.S. and Europe (e.g., SAE paper no. 2010-01-0365 authored by Southwest Research Institute, SAE paper no. 2011-01-0814 authored by NGK, and a technical paper authored by Dow Automotive Systems at the 2010 Aachen Colloquium). Like diesel particulate filters, gasoline particulate filters are capable of reducing particle emissions by more than 85% over a wide range of particle sizes, including high capture efficiencies for ultra-fine particulates. The application of a GPF on a four cylinder gasoline direct injection vehicle is expected to cost approximately $100, making this emission control technology a cost effective solution for reducing particulate emissions from future gasoline vehicles. When these filters are properly designed, the impact of a GPF installation on the backpressure and fuel efficiency of the vehicle is expected to be minimal.

ARB needs to make sure that these same ultra-low PM, Euro 6 GDI engines/technologies are also utilized in California. To that end, MECA believes that it is critically important for ARB to hold a formal technology review around their proposed 1 mg/mile PM light-duty vehicle PM standard in the 2017 timeframe. In this review, ARB should consider the stringency, form, and timing of this PM standard. It is important for California to continue to set the bar on light-duty vehicle emission standards, to encourage the development and use of best available control technologies for light-duty vehicles. ARB has a long history of setting technology forcing vehicle standards and this leadership needs to continue with respect to light-duty vehicle particle emission standards.

MECA supports ARB's proposed changes to their light-duty vehicle on-board diagnostic (OBD) requirements. In particular, MECA believes that ARB's proposal has struck the right balance on the introduction of a tighter PM efficiency diagnostic threshold for diesel particulate filters (DPFs). It is important for ARB to continue to encourage the development of commercial opportunities for particulate sensors for both light-duty and heavy-duty diesel vehicle OBD applications. MECA believes that particulate sensor options to meet ARB's OBD requirements will continue to expand in the near future.

MECA supports ARB's proposed post-2016 greenhouse gas emission standards for light-duty vehicles. Implicit in federal and state greenhouse gas emission analyses is the ability of these advanced powertrain options to meet the applicable criteria pollutant emission standards, such as CO, NOx, and non-methane organic gases (NMOG). All of these advanced, light-duty powertrain options combined with the appropriately designed and optimized emission control technologies can meet all current and future federal and state criteria emission requirements. In this manner, advanced emission controls for criteria pollutants enable advanced powertrains to also be viable options for reducing greenhouse gas emissions. A range of powertrain technologies, including engine turbochargers, exhaust gas recirculation systems, advanced fuel systems, variable valve actuation technology, advanced transmissions, hybrid powertrain components, and powertrain control modules that can be applied to both light-duty gasoline and diesel powertrains to help improve overall vehicle efficiencies, reduce fuel consumption, both of which can result in lower CO_2 exhaust emissions. In many cases, the application and optimization of advanced emission control technologies on advanced powertrains can be achieved with minimal impacts on overall fuel consumption. Auto manufacturers will also take advantage of synergies between advanced emission control technologies and advanced

powertrains to assist in their efforts to optimize their performance with respect to both greenhouse gas and criteria pollutant exhaust emissions.

Future light-duty diesel powertrains will continue to use emission control technologies like diesel particulate filters, NOx adsorber catalysts, and selective catalytic reduction catalysts to meet ARB's proposed LEV III light-duty exhaust emission standards. Emission control manufacturers are working with their auto manufacturer partners to further optimize these emission control technologies to be more effective at reducing criteria pollutants and play a role in reducing vehicle greenhouse gas emissions. Advanced diesel emission control technologies like particulate filters with lower backpressure characteristics, SCR catalysts with improved performance at lower exhaust temperatures, and SCR catalyst coated directly on particulate filter substrates are examples of emerging diesel emission control technologies that will allow future diesel powertrains to not only be as clean as gasoline engines from a criteria pollutant perspective, but deliver improved fuel consumption characteristics and lower greenhouse gas emissions. The use of diesel particulate filters also delivers significant reductions in black carbon emissions from diesel engines, a combustion emission that also has important climate change impacts.

For gasoline vehicles, direct injection technology enables gasoline engines to achieve greater fuel efficiency and is expected to be a dominant pathway to meeting future light-duty greenhouse gas emission standards. Again emissions controls ensure that these more fuel efficient gasoline engines meet tough EPA or California criteria emission regulations. Under stoichiometric conditions, three-way catalysts are used to achieve ultra-low emissions of NOx, HC and CO. Advanced high performance, three-way catalysts and secondary air injection technology are available and will continue to evolve and be optimized to ensure that future gasoline direct injection engines will meet the toughest criteria pollutant emissions standards with minimal impacts on overall vehicle exhaust system backpressure and fuel consumption.

Tightening of hydrocarbon and NOx emission standards over time with the parallel introduction of more effective emission control systems have resulted in lower emissions of N_2O and CH_4 from today's vehicles compared to older vehicles certified to less stringent hydrocarbon and NOx standards. The performance of advanced emission control technologies for advanced diesel, gasoline, and natural gas-fueled powertrains can also be optimized to minimize N_2O and CH_4 emissions from future light-duty vehicles consistent with the limits EPA set for these important greenhouse gas emissions in their first round of light-duty vehicle greenhouse gas emission standards.

Emission controls for gasoline and diesel engines are also generally compatible with low carbon, alternative fuels (e.g., gasoline blends with renewable ethanol or biodiesel blends) that can provide additional reductions in mobile source greenhouse gas emissions. Engine operating strategies and emission control catalyst formulations, however, often need to be optimized depending on fuel composition to ensure that criteria pollutant emissions or other air toxic emissions are minimized. It is also important that specifications associated with any low carbon fuel should be compatible with the use of available exhaust emission control technologies.

In summary, there are significant opportunities to reduce both criteria pollutant and greenhouse gas emissions from the transportation sector through the design of fuel efficient powertrains that include advanced exhaust emission controls for meeting even the most stringent criteria pollutant standards that are included in ARB's proposed LEV III program. MECA believes that advanced emission control systems have a critically important role in future policies that aim to reduce mobile source criteria pollutant and greenhouse gas emissions. These advanced exhaust and evaporative emission control technologies will allow all current and future high efficiency powertrain options to comply with ARB's proposed LEV III criteria pollutant standards, thus enabling these powertrains to be viable options for complying with existing and proposed ARB and EPA greenhouse gas pollutant standards. In nearly all cases, these fuel-efficient powertrain designs, combined with appropriate emission controls, can be optimized to either minimize fuel consumption impacts associated with the emission control technology, or, in some cases, improve overall fuel consumption of the vehicle. This optimization extends beyond carbon dioxide emissions to include other significant greenhouse gases such as methane and nitrous oxide. MECA urges ARB to include a mid-term, formal review on their proposed 1 mg/mile light-duty vehicle PM standard to ensure that future gasoline vehicles that are introduced into the California market include the best available technologies for minimizing particulate emissions from these vehicles.

MECA commends ARB for taking important steps to reduce criteria pollutant emissions, greenhouse gas emissions, and improve fuel economy from light-duty vehicles. Our industry is prepared to do its part and deliver cost-effective, advanced emission control technologies to the market.

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