National Marine Manufacturers Association

July 1, 2013

Air and Radiation Docket and Information Center
Environmental Protection Agency
Mail Code: 2822T
1200 Pennsylvania Ave. NW
Washington DC 20460

Re: Control of Air Pollution From Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards (EPA-HQ-OAR-2011-0135)

Dear Sir/Madam:

The National Marine Manufacturers Association (NMMA) appreciates the opportunity to provide comments to the Environmental Protection Agency regarding its proposed rule titled "Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards" (78 *Federal Register* 29816) published on May 21, 2013. NMMA's focus is on the EPA's request for comment regarding changing the automotive and light duty truck certification fuel to E15, and perhaps higher, and its effect on boats and marine engines due to potential misfueling and continued availability of suitable fuel.

As background, NMMA is the leading recreational marine trade association in North America. NMMA member companies produce more than 80 percent of the boats, engines, trailers, accessories and gear used by boaters and anglers throughout the United States and Canada. Recreational boating has an estimated annual economic impact of $121.5 billion. Eighty-eight million Americans participated in boating in 2012. Importantly, an estimated 93 percent of boats sold in the U.S. in 2012 were made in the U.S.

The NMMA is not opposed to the use of ethanol as an additive in gasoline. Our members have been designing their engines and fuel systems to be compatible with E10 since the early 1980's. Our very serious concern is that the 12.1 million recreational boats currently registered the United States, and those boats currently being manufactured, have not been designed to be compatible with gasoline that has ethanol content greater than 10%. Recreational marine fuel systems are not unique in this regard. The overwhelming majority of non-road engines, from chainsaws to weed trimmers to lawn mowers, operate similarly to recreational marine engines with open loop systems including a carburetor that is set at the factory and designed to be—and required by EPA to be--tamper proof.

In addition to the well-documented physical evidence of ethanol's damaging effects on marine and other non-road engines, NMMA's concerns are also based on the physical properties of ethanol in gasoline. Gasoline is a mixture of many hydrocarbon compounds that consist mainly of hydrogen and carbon. Ethanol contains hydrogen and carbon, but it also contains oxygen. The exact air-fuel ratio needed for complete

combustion is called the “stoichiometric air-to-fuel ratio.” This ratio is about 14.7 to 1 on a weight basis for gasoline that does not contain any ethanol. When more ethanol is added to gasoline, less air is required for complete combustion because oxygen is already contained in the ethanol. For example, for E10 the stoichiometric air-to-fuel ratio is 14 to 14.1 pounds of air per pound of fuel. The stoichiometric air-to-fuel ratio for straight ethanol is 9 to 1, so as the proportion of ethanol in gasoline increases so must the air-to-fuel ratio decrease. To deliver the required power for a given operating condition, engines are designed to consume enough air and fuel to generate the required energy. The marine engine is designed and calibrated to anticipate a specific fuel-to-air ratio and nothing different. Because ethanol blended fuels require more fuel for the same amount of air to achieve stoichiometric conditions, the fuel system must adapt by introducing more fuel. If additional fuel is not introduced to compensate for the ethanol, the resulting mixture has less fuel than needed and the engine experiences a condition known as “enleanment.”

Enleanment can lead to a variety of performance problems. For example, the combustion and exhaust gas temperatures will be higher, engine starting may be harder, and the engine speed control may become inaccurate. The increased combustion and gas temperatures resulting from lean operation can result in severe damage to pistons, head gaskets, catalysts and emission related components, which in turn may result in the failure of the engine and increased exhaust emissions.

A series of engine evaluations conducted by Mercury Marine and Volvo Penta under direction of the Department of Energy (DOE) National Renewable Energy Laboratory (NREL) concluded that ethanol content in gasoline at 15% by volume will severely damage marine engines and cause them to exceed the EPA emission standards.[1] There is no remedy for this engine damage and emission standard exceedances and it is not limited to recreational marine engines. These same issues apply to other product categories including outdoor power equipment, heavy duty engines, and snowmobiles. If E15 becomes the primary fuel in the US marketplace, misfueling will occur, EPA and California emission standards will be violated, engines will be damaged, and the American consumer will be stuck paying the bill for a misguided US government policy that needs to be corrected now.

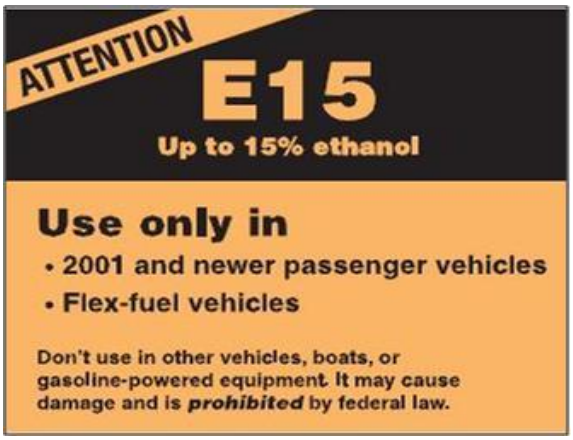
EPA requests comment on proposing to change the certification test fuel to E15 and supports this by stating that the requirements in the Renewable Fuel Standard (RFS-2) will result in E15 becoming the predominant fuel in the US marketplace in the next 10-15 years (78 *Fed. Reg. at* 29,909.) The RFS-2 requires that the US fuel supply contain 36 billion gallons of renewable fuel by 2022. When the RFS-2 was created in 2007, fuel consumption in the US was rising, the NHSTA motor vehicle fuel efficiency standards had not been promulgated, and the US government had great hope for the consumer

[1] Calhoon, M., Kolb,R., Zoubul, G. “4.3GL E15 Emissions and Durability Test”, Volvo Penta report(June 2011).
Hilbert, D., “High Ethanol Fuel Endurance: A Study of the Effects of Running Gasoline with 15% Ethanol Concentration in Current Production Outboard Four-Stroke Engines and Convention Two-Stroke Outboard Marine Engines”, National Renewable Energy Laboratory, (June 2011).

acceptance of E85. Since 2007, fuel consumption in the US has decreased significantly with expectations of its continued fall. E85 consumption reached a high of 38.6 million gallons in 2011 and consumption has remained flat since then. The E85 contribution to achieving the requirements in the RFS-2 is insignificant.

E15 can never achieve the requirements of RFS-2. This proposed change to the EPA certification test fuel will not even come close to achieving the RFS-2 requirements. EPA would need to mandate E20, E25 or even E30 for all engines immediately to meet 36 billion gallons in nine years. Such action would not be logical or responsible. Thus, EPA is attempting to create a piecemeal approach to achieving a federal requirement that cannot be achieved without great cost to vehicle and engine owners. The RFS-2 is a broken government mandate that may have made sense in 2007, but does not work today. NMMA recommends that the certification fuel remain at E10 and that EPA formally request that Congress and the Administration amend the Renewable Fuel Standard to reflect America's realistic motor fuel resources for 2013 and beyond.

EPA also requests comment on a plan to allow the use of E10 as the certification test fuel with a transition scheme to E15 in the future (78 *Fed. Reg.* at 29,910). This would create far more confusion for consumers than an immediate mandate to E30. At this time, gasoline retailers that choose to sell E15 must clearly label the gasoline pump with the following specific language:



If E15 becomes the certification test fuel for automobiles and light trucks, it will soon be the primary fuel in the marketplace. Being the primary fuel in the marketplace, marine engine manufacturers will have to follow suit and design engines to operate on E15. However, their open loop engines require a fuel to air ratio for optimum combustion that is limited and far less able to tolerate variation in fuel oxygen content. In other words, an engine designed for 2.5% oxygen will not operate efficiently or meet the emission standards with a fuel containing 5% oxygen.

NMMA is also concerned with consumer labeling. The current label (see above) clearly states that if the consumer uses E15 in any engine other than a 2001 and newer passenger vehicles, it is a violation of federal law. If E15 is the only available fuel in the marketplace, breaking this law seems inevitable. Is this violation of federal law a

misdemeanor or a felony? When does the label come off; when does it stay on? When does it apply, when doesn't it apply? NMMA is concerned that this proposal shows no consideration for the consumers who own the millions of lawn mowers, garden equipment, farm machinery, snowmobiles, and marine engines that will be damaged and no longer covered under manufacturer warranties. This automobile and light truck proposal will start the process of moving the nation's fuel supply to E15 and destroying marine and other non-road engines in the process.

EPA requests comment regarding the option of allowing the use of CARB E10 certification test fuel through model year 2019 with a Reid Vapor Pressure (RVP) of 10 psi (78 Federal Register 29895). EPA currently provides a 1 psi waiver for E10, but this waiver will not apply to E15. NMMA recommends that the 1 psi waiver also be eliminated for E10. EPA finalized a rule in 2010 that requires boat builders to meet stringent new evaporative emission requirements. California is currently in the process of finalizing a rule. In order to meet these new emission standards, marine engine manufacturers need a combination of new technology and a fuel with a minimum evaporation rate.

EPA requests comment regarding an option that would allow vehicle manufacturers to certify using a 30 percent by volume ethanol blend (E30) in recognition that E85 has not met EPA's expectations and to encourage light duty vehicle manufacturers' efforts to continue to determine what might be the optimal ethanol content. Given the large difference in oxygen content between E10 and E30 this approach will only cause further confusion and misfueling of marine engines when E30 reaches the marketplace, as would appear to be inevitable based on EPA's proposal. This bifurcated approach of allowing E10, E30 and E85 in the marketplace does nothing to address the root problems associated with ethanol-enhanced fuels: ethanol is not gasoline.

The California Air Resources Board (CARB) recently approved a staff recommendation requiring all nonroad spark-ignition exhaust emission certification requirements to be met utilizing E10 certification test fuel beginning in model year 2020. NMMA testified at the CARB Board hearing requesting that the board also allow for the use of an alternative California certified advanced biofuel, if available.

For the past three years, NMMA has been working with the US Department of Energy and Argonne National Laboratory to evaluate a better alternative to ethanol, both as an oxygenate and a biofuel. Our research and testing of isobutanol is a result of the problems associated with increased levels of ethanol being used as a fuel additive. Our research findings include:

- Ethanol raises the Reid Vapor Pressure of gasoline, which at higher levels increases evaporative emissions. Meeting US EPA and CARB RVP standards for ethanol blends therefore requires refineries to perform additional processing.

- Ethanol is corrosive and is typically shipped via railcar or truck versus less expensive pipelines.

- Ethanol is splash blended at the end of the gasoline refining process, adding additional storage and labor cost.

- Ethanol is hygroscopic, meaning it has an affinity for water.

- Ethanol at 10% by volume contains approximately 2.5% oxygen. Increasing ethanol content in gasoline increases the oxygen level (referred to as enleanment) causing open loop engines to experience increased combustion temperatures.

Rather than simply oppose all ethanol and biofuels, NMMA has dedicated considerable resources over the past three years to evaluate isobutanol in order to contribute meaningful data to steer future biofuels policy and ensure compatibility with millions of non-road engines and boats.

Recreational marine engines and vessels represent a worst-case environment in which to validate the reliability and compatibility of advanced biofuels such as isobutanol due in part to the usage cycles of marine products, open-vented fuel systems, likelihood of introducing saltwater into fuel systems and open-loop engine operation. Successful demonstration of isobutanol-extended gasoline in the marine environment may ensure that engine emissions, engine and vessel performance, engine durability and product safety (fuel system related) could be maintained for millions of small engines including recreational marine engines and vessels. Moreover, successful testing in a worst-case marine environment will allow for a more streamlined acceptance of advanced biofuels outside of on-road vehicles, potentially minimizing the effects of the current bifurcated fuel system.

NMMA has conducted tests on a variety of marine engines and vessels using 16% isobutanol by volume, which has similar oxygen content to E10, without the other negative properties of ethanol identified above. The results of our documented and published research thus far indicate that isobutanol at 16% by volume yields very similar engine emissions, durability, power and performance as E10. [2]

[2] Wallner et al. "Emissions and Operability of Gasoline, Ethanol, and Butanol Fuel Blends in Recreational Marine Applications" U.S. Department of Energy Fuel & Lubricant Technologies Annual Progress Report 2012

Wasil, J., McKnight, J., Kolb, R., Munz, D. et al., 'In-Use Performance Testing of Butanol-Extended Fuel in Recreational Marine Engines and Vessels,' SAE Technical Paper 2012-32-0011, 2012, doi:10.4271/2012-32-0011

Wasil, J., Johnson, J., and Singh, R., "Alternative Fuel Butanol: Preliminary Investigation on Performance and Emissions of a Marine Two-Stroke Direct Fuel Injection Engine," SAE Int. J. Fuels Lubr. 3(2):1071-1080, 2010, doi:10.4271/2010-32-0054

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This summer, NMMA is conducting tests with Argonne National Laboratory under the direction of the U.S. Department of Energy on a tri-fuel blend of 5% ethanol, 8% isobutanol and 87% gasoline to determine the effects on emissions, performance and overall fuel compatibility with recreational marine engines and vessels. Our preliminary analysis has shown that isobutanol acts to lower Reid Vapor Pressure, while also increasing the overall biofuel quantity in gasoline.

NMMA strongly urges EPA and DOE to take a leadership role in appealing to Congress and the President to freeze ethanol at 10%, while neutral party technical evaluation are conducted to assess alternatives that can be introduced at a higher concentration without the negative effects of ethanol.

Thank you for the opportunity to provide comments on this important issue that affects all of us. If you have any questions, please do not hesitate to contact me at jmcknight@nmma.org or 202-737-9757.

Sincerely,

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