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**Testimony of John McKnight, NMMA before the California Air Resources Board regarding the Public Hearing to Consider the Proposed Amendments to California's Small Off-Road Engine and Tier 4 Off-Road Compression Ignition Engine Regulations and Test Procedures; and Amendments to the Exhaust Emission Certification Test Fuel for Off-Road Spark Ignition Engines, Equipment and Vehicles**

Good morning afternoon. My name is John McKnight and I am the Director of Environmental and Safety Compliance for the National Marine Manufacturers Association. NMMA is the leading national recreational marine trade association, with nearly 1,400 members involved in every aspect of the boating industry. NMMA members manufacture over 80 percent of recreational boats, engines, trailers, accessories, and gear used by boaters and anglers in the United States.

Both myself and NMMA members have testified before this board on countless occasions. While NMMA has not always agreed with CARB's proposed new requirements, we have always worked with the Board to develop achievable outcomes. Today we are trying to provide some insight into what we know through fuel testing of marine engines and fuel system components that may be helpful to CARB in choosing the correct path towards in requiring a future change in the certification fuel.

It is no secret to boaters or manufacturers in the marine industry that ethanol enhanced fuels cause problems to marine engines. Whether it is water absorption, corrosion to fuel system components and fuel tanks, or phase separation, the move to E10 has been both challenging and costly to boaters. With this knowledge and the EPA's plan to allow for the introduction of E15 in the market, NMMA has committed some resources working with both the Department of Energy and the US Coast Guard to see if first E15 will seriously damage marine engines and second is there possibly a renewable fuel that could be developed that does not have the detrimental properties of ethanol.

The bottom line is that E15 is out of the question for application in legacy small engines and many automobiles. From the results of the testing I have seen, I believe that it is a bad idea for automobiles 2001 and later, but I guess time will tell. I have included in my written comments pictures and summary slides of the results of the DOE funded E15 tests on marine engines and they speak for themselves. Refocusing on the CARB proposal to require E10 certification fuel in 2019, I would hate to see either California or EPA limit the potential of more advanced "drop in" renewable fuels by specifying a particular fuel now that may or may not be the best available fuel technology in 2019. I only say this because NMMA has had the opportunity this summer to evaluate isobutanol at 16.1% in a US Coast Guard funded project. NMMA decided to test isobutanol at 16.1% because at that concentration it has the same oxygen content as E10. Preliminary emissions results show that 16.1% isobutanol has HC+NOx very similar to current EPA and CARB certification fuel with slightly lower CO.

Through this testing which evaluated the effects of isobutanol on fuel system components, engine exhaust emissions and vessel operation, NMMA is confident to state that this next generation renewable fuel maybe the answer to achieving our nation's renewable fuel objectives, without the negative effects that we have seen that ethanol has on both new and legacy Marine SI and SORE engines.

In summary...NMMA knows that E15 is bad for California...given enough time NMMA members can certify their engines to E10, but in doing so, we might close the door to the next generation of renewable fuels by mandating use of a singular biofuel. Instead, NMMA suggests that CARB take a broader approach and allow the use of CARB approved fuels with the equivalent oxygen content of E10.

## National Marine Manufacturers Association (NMMA) and American Boat and Yacht Council (ABYC) Summer Butanol Test Program Summary

Considered an advanced biofuel in the U.S Renewable Fuels Standard, butanol is a four-carbon alcohol that has an energy content closer to that of gasoline. It contains approximately 30% more energy than ethanol and can be produced from biomass feedstocks in a fermentation process. Since butanol contains more energy, it can be blended into gasoline at higher percentages -- 16.1% butanol-extended fuel is equivalent to 10% ethanol-extended fuel in terms of the energy and oxygen content. Unlike ethanol, butanol is unlikely to absorb water and phase-separate. Due to the low solvency of butanol, it could be transported in the existing pipeline distribution infrastructure, eliminating the need for local splash blending which is required for ethanol-extended fuels. Additionally, butanol is considered a "drop-in" fuel and is believed to be more compatible with existing engines and fuel systems as compared to ethanol.

Based on the aforementioned highlights and results from a preliminary study on a marine engine<sup>1</sup>, butanol-extended fuels look very promising in terms of compatibility with existing engines, fuel systems and the overall fuel distribution infrastructure. To that end, NMMA and ABYC conducted a summer test program in which three boats were operated during the boating season to evaluate the effects of butanol-extended fuel<sup>2</sup>. Emissions, power, performance and overall engine runability were measured and recorded. Additionally, tests were conducted on individual boat fuel system components.

Throughout the summer test program, the boats performed very well operating on butanol-extended fuel. With respect to engine emissions, butanol-extended fuel resulted in similar hydrocarbons plus oxides of nitrogen as compared to tests conducted on standard EPA certification fuel. A reduction in Carbon Monoxide was observed with butanol-extended fuel and was expected due to the fact that butanol is partially oxidized. Results from individual fuel system component tests also were very encouraging as none of the components deteriorated or broke-down as a result of exposure to butanol.

The results of this preliminary testing program clearly indicate that butanol may be an advanced biofuel with properties better suited for marine engines, and, more importantly, millions of non-road gasoline engines.

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<sup>1</sup> Wasil, J. Johnson, J., Singh, R., 'Alternative Fuel Butanol: Preliminary Investigation on Performance and Emissions of a Marine Two-Stroke Direct Fuel Injection Engine' SAE Paper 2010-32-0054

<sup>2</sup> *NMMA Evaluates Promising Alternative Biofuel*

<http://www.nmma.org/press/pressreleaselibrary/pressrelease.aspx?id=18052>

### **Part III. Emission Test Equipment Provisions.**

#### **44. Lubricating Oil and Test Fuel.**

The purpose of this section is to identify the fuel and engine lubricant specifications that are to be used for certification testing. This section was amended to allow spark-ignition marine engine manufacturers the optional use of the new California 10-percent ethanol-blend gasoline (E10) certification test fuel or a CARB certified equivalent renewable test fuel, which ARB will adopt for 2015 and subsequent model on-road motor vehicles, for 2013 through 2018 model-year vessels and engines. Use of this E10 certification test fuel or an equivalent renewable CARB certified test fuel will become mandatory beginning with the 2019 model year. The proposed optional and required use of this E10 or equivalent renewable certification test fuel is applicable to only exhaust emission test purposes.

(b)(1)W - 2 (i) The purpose of this subsection is to identify the fuel to be used for certification testing of current production spark-ignition marine engines. This subsection was amended for formatting reasons.

(ii) The purpose of this new subsection is to provide manufacturers the alternative of using the new California 10-percent content of ethanol-blend gasoline (E10) or equivalent renewable certification test fuel for model years 2013-2018.

(b)(2) The purpose of this new subsection is to require the new California 10-percent content of ethanol-blend gasoline (E10) or equivalent renewable certification test fuel for all 2019 and later model-year spark-ignition marine engines.