Comment on Automaker's Draft World Wide Fuel Charter Edition 5
Related to "Methanol is not permitted" Statement
By Methanol Institute
February 27, 2013

Summary

The Methanol Institute serves as the trade association for the global methanol industry, and we appreciate this opportunity to comment on the proposed 5th Edition of the Worldwide Fuel Carter. Since its inception in 1998, the World Wide Fuel Charters (Editions 1 through 4) have continued to advise against the use of commercial methanol blending in gasoline with the following statement (but without supporting technical references):

"Methanol is not permitted. Methanol is an aggressive material that can cause corrosion of metallic components of fuel systems and the degradation of plastics and elastomers."

Based on many past technical studies conducted by automakers, governments, oil industry, and others as well as the successful commercial experience of properly blended methanol in gasoline during periods of high crude oil prices over the past 30+ years (in U.S. and Europe during the 1980's and 1990's and now in China since 2004), the automakers' current warning statements on material incompatibility and toxicity concerns against the blending of low levels of methanol in gasoline do not appear to be warranted or supported.

Even though many automakers had previously used informative and supportive statements for methanol gasoline blends in their vehicle owner manuals in the 1980's through the mid-1990's, many automakers since the late 1990's had changed to warning statements in their vehicle owners manuals similar to that of the WWFC against the use of methanol gasoline blends. In addition to raising concerns about possible fuel system material incompatibility with commercial methanol blends, some automakers have also proposed that methanol's toxicity is another possible reason that methanol should not be used in gasoline even though past hazard and health risk reviews by a number of government agencies have found methanol as a fuel component to be similar or even lower in risk than gasoline itself.

Further, the inclusion of this methanol prohibition statement runs counter to current fuel standards in many parts of the world, as well as market development initiatives. The current European Union fuel standard – EN 228 – allows for the use of up to 3% methanol with a co-solvent, and this blend is being utilized in several member state markets. More than a dozen provinces in China have fuel standards that allow for methanol fuel blending, principally M15 blends, and the central government is in the final stages of adopting a nationwide M15 fuel standard. The U.S. Environmental Protection Agency recently approved petitions for the use of corrosion inhibitors with the use of the Octamix blend of 5% methanol and 2.5% co-solvent under the waiver provisions of the Clean Air Act's "substantially similar" rule. We are also seeing methanol fuel blending development activities in Australia, United Kindom, Netherlands, Iceland, Sweden, Israel, Iran, Pakistan, Uzbekistan, Azerbaijan, Trinidad, New Zealand and Vietnam.

Our comments here reference a library of technical documents which show that properly blended methanol in gasoline with adequate corrosion inhibitors and co-solvents provides satisfactory and adequate performance, service life and safety in existing gasoline vehicles. While you will note that many of these references refer to studies conducted in the 1980's and 1990's, if anything, the global fleet of vehicles produced today has an even more robust

ability to safely and effectively operate on increasing volumes of alcohol blended fuels. The automakers' fuel charter should now accept properly blended methanol in gasoline as a viable commercial fuel additive for adding clean burning octane and for cost effectively displacing petroleum energy from gasoline supplies, particularly since methanol blends are already being used or considered in a number of countries. **The WWFC Committee plans to produce a Response to Comments document, and we challenge the Committee to provide an equally referenced response the these comments from the Methanol Institute that justifies the continued prohibition on methanol blended fuels.**

Experiences with Methanol Fuel Blend Compatibility

Based on previous studies as well as field experience with fuel system materials (metals and non-metals), the automakers and fuel system OEM's had developed recommended industry guidelines for screening and selecting fuel system materials using a M15 reference fuel (15% methanol in reference gasoline). This recommended industry guideline from SAE (Society of Automotive Engineers) had been issued in the early 1990's (SAE J1681 – 1993). Also, as demonstrated in commercial ethanol blends, the use of commercial corrosion inhibitors (fuel additives) have been shown to provide sufficient corrosion resistance protection of fuel system metals with methanol gasoline blends up to 15 percent.

A. Pre-1990 Fleet Studies found that M15 Operates Satisfactory in Existing Vehicles

A number of fleet studies involving automakers during the late 1970s and the earlier 1980s conducted with large numbers of vehicles over one or more years of operation have indicated that M15 fuel blends provide satisfactory performance with little or no significant modifications of the vehicles typically manufactured at that time. These large regional studies had included Germany (~1000 vehicles), Sweden (~1000 vehicles), New Zealand (~950 vehicles), and China (~500 vehicles). [Ref. 1-10]

The M15 fuel in these earlier programs generally used small amounts of co-solvents alcohols (typically 1 to 3 volume percent) so as to provide sufficient water tolerance or cold-temperature phase stability as well as the addition of commercial inhibitors (fuel additives) to maintain corrosion resistance of the methanol gasoline blend.

B. Improved Fuel System Materials Provide Methanol Fuel Blend Compatibility

Early laboratory research and fleet studies found corrosion inhibitors to be effective in controlling the corrosion tendency of M15 fuels.[Ref. 5 & 7] However, these early fleet field studies found that a few of pre-1980 vintage elastomers used in parts of these older vehicle fuel systems could experience shortened service life, but were easily upgraded with available higher quality elastomeric replacement materials in the vehicle fuel systems.

During the early 1980's, the part suppliers (OEM's) and automakers evaluated and screened the commonly available elastomers and plastics for compatibility with the alcohols blends (methanol and ethanol), and then publicly shared this knowledge [Ref. 11-13] with automakers for use in engineering design selections of fuel system materials in newer vehicles as well as for the fuel system replacement parts. Following the 1980's, the fuel system parts and elastomer suppliers then developed and provided more durable elastomer formulations that better tolerated M15 gasoline blends in addition to other alcohol blends.[Ref. 14-20] In the early 1990's, the automakers developed SAE (Society of Automotive Engineers) guidelines that recommended using a M15 gasoline blend as the key screening reference fuel for selecting the materials to be used in the new vehicle fuel systems.[Ref. 21-23] Therefore, as long as the automakers and OEM's of fuel system components have been following their own SAE recommended industry guidelines for selecting fuel system materials, the elastomer

and the plastic fuel system materials being typically supplied to the automakers since the early 1990's should essentially be fully compatible with gasoline blends containing up to 15% methanol.

C. Proper Co-solvents and Fuel Corrosion Inhibitors Provide Adequate Metal Protection

Although pure methanol tends to be a little more corrosive to some metals than pure ethanol in general, the experience gained from the large early M15 fleet trials showed that fuel system metals could be adequately protected in methanol fuel blends by including two other stabilizing additives: (1) fuel corrosion inhibitors to neutralize and protect metal surfaces, and (2) adequate co-solvents to increase water tolerance and thereby mitigate possible phase separation coming in contact with metal surfaces.[Ref. 5 & 7] Using this knowledge to protect vehicle fuel system materials with methanol blends, AtlanticRichfield Company (ARCO) successfully introduced commercial methanol fuel blends (Oxinol blending components) for use in the U.S. and the European gasoline markets during much of the 1980's when crude oil prices were still relatively high. The dual protection approach of using both co-solvents for adequate water tolerance as well as corrosion inhibitors became the industry standard for all commercial methanol blend fuel waivers approved by the U.S. EPA during the 1980's such as the Octamix fuel wavier in 1988. Many automakers also incorporated this dual protection guidance (corrosion inhibitors and co-solvents) in their vehicle owner manual statements in the late 1980's through the mid-1990's for when consumers elected to use methanol blends in their vehicles.

Little more than one year ago, two separate petitions to allow for other commercial corrosion inhibitor additives to be used as alternatives or substitutes in the Octamix Fuel wavier formulation were issued for public comments by the U.S. EPA. [Ref. 24, 25] Even though the EPA comment request was about these additives providing adequate corrosion protection of metals in vehicle fuel systems with methanol gasoline blends, there were no unfavorable comments submitted by any of the automakers to dispute the claims for either petition. Therefore, if the automakers could truly demonstrate that commercial methanol blends using corrosion inhibitors and co-solvents should not be permitted in commerce because it could lead to "corrosion of metallic components of fuel systems" in vehicles, this public comment request from EPA would have been the most appropriate opportunity to provide such technical data or analysis. However, as a result since no unfavorable comments were submitted from the automakers, the U.S. EPA approved both petitions in 2012 which essentially reaffirms the basis of the Octamix methanol blend fuel waiver that properly blended methanol blends with sufficient corrosion inhibitors and co-solvents will not contribute to a shorten service life of vehicle fuel system materials, or to an increases in vehicle emissions.

Fuel Use of Methanol Determined as No More Hazardous or Toxic than Gasoline

With the growing interest of methanol fuels during the 1980's, the U.S. EPA (Environmental Protection Agency) had evaluated the toxicity, safety and hazards of handling and using methanol fuels (M85 and M100) as vehicle fuel, and had determined that the health and other risks of methanol fuels to be similar or even less than that of conventional gasoline.[Ref. 26-28] Although the EPA did not evaluate low level methanol fuel blends (like M15 or M5), the exposure risks of lower methanol content fuels are expected to be less than using M85 fuel blends evaluated by the EPA. During their evaluations, the EPA found that any potential estimated methanol exposures would safely fall within the health risk criteria for methanol. Because of the lower methanol content, the methanol exposures with low level methanol gasoline blends (M3-M15) would expect to be much lower than that estimated for M85 fuels by at least a factor of 5.

Other authorities have also evaluated the potential health risk exposure to methanol when used as a fuel or fuel blending component, and also have found a large margin of safety.[Ref. 32-35]

In addition, as part of their large M15 vehicle fleet trials, New Zealand authorities had reviewed the toxicity and hazard risks associated with methanol fuels, and also had determined methanol in fuels to have similar or lower risks than that of gasoline.[Ref. 4]

When evaluating M15 fleets in China, various China authorities went even further by actually measuring time weighted methanol exposure of personnel in the methanol blend supply chain as well as the vehicle drivers and vehicle mechanics, and had found the measured methanol exposures for all the personnel to fall safely within the health risk exposure standards for methanol.[Ref.29-31]

In the unlikely case of spill or leak of fuel with methanol into surface waters or ground waters, the exposure risks were estimated to be very low because of the relatively short half-lives for methanol in the water environment which is a result of methanol's relatively high biodegradability. [Ref. 36-37]

Favorable Market Experience with Methanol in Automotive Use

For decades, methanol has a number of on-going automotive uses with consumer exposures such as windshield washer fluid (up to 30+% methanol) and gas-line antifreeze (near 100% methanol) which are commonly purchased by the vehicle owner in supermarket stores along with their food items. These methanol containing automotive products are commonly poured into the vehicle by the consumers from open containers where the consumer is easily exposed to the methanol containing fluid. Besides the vehicle spraying washer fluid on windshield where it evaporates into the nearby breathing environment, many times the consumer will directly clean the vehicle's windshield using the available hand squeegee soaked with the windshield washer fluid when at gasoline filling stations. In the case of gas-line antifreeze, the methanol from the typical 12 oz container can easily achieve 4% methanol in the gasoline when poured into a near empty fuel tank, and this methanol will not contain any corrosion inhibitors or co-solvents. Although automakers raise concerns about using properly blended methanol in gasoline, the same vehicles' owner manuals raise no warning or guidance on the use of these higher concentration methanol automotive products. Therefore, it hard to fathom how the automakers believe that methanol which is pre-mixed in gasoline should be of any greater concern to the consumer or the vehicle fuel system than the use of these other convenient and safe automotive methanol containing products.

As recent as the late-1990's, automakers were still selling M85 Flexible Fuel vehicles in the U.S. markets. In 1989, domestic automakers were promoting methanol as the possible fuel of the future.[Ref. 38] In 2003, Ford reviewed all the potential benefits of methanol as a preferred, safe, and sustainable fuel in the future, and supported the EPA's risk review that methanol as a fuel did not present a higher health risk than gasoline.[Ref. 39]

In the case of China's experience, to reduce its dependency on imported crude oil, the number of provinces that are commercializing M15 blends has been growing since 2004 when the global price of crude oil began ascending from less than $40 per barrel up to $100 per barrel and higher. Although M15 use and experience has been widely expanding since 2004 – and today represents as much as 8% of China's transportation fuel pool – China's domestic automakers have not found it necessary to add any cautionary statements on methanol in their vehicle's owner manuals even though the fuel system materials are likely the same as those in other global markets.[Ref. 40,41] China's successful experience with commercializing and growing the M15 fuel blend market in the existing vehicle fleet without need for modification has been investigated and summarized by IAGS (Institute for the Analysis of Global Security). [Ref. 42]

REFERENCES:

(1) "Technical and Economical Aspects of Methanol as an Automotive Fuel", SAE 760545, A. Koenig, W. Lee & W. Bernhardt, Volkswagenwerk AG (Germany)

(2) "Gasoline-Methanol Fuels: Blending Optimsation with Respect to Manufacturing Economics and Engine Performance", R.W. Hooks, K.H. Reders & A.A. Reglitzky, Deutsche Shell AG, West Germany, International Symposium on Alcohol Fuel Technology Methanol and Ethanol, Nov 1977, Federal Republic of Germany

(3) “Methanol-Gasoline Blended Fuels in West Germany – Specification and Early Field Experience”, B. Nierhauve, ARAL Research Center, West Germany, Proceedings of the IV International Symposium on Alcohol Fuels Technology, Brazil, October 1980, Volume 1, pgs 319-324

(4) “The M-15 Blend Test Programme of the New Zealand Liquid Fuels Trust Board”, J. Duncan, Proceedings of the IV International Symposium on Alcohol Fuels Technology, Brazil, October 1980, Volume 2, pgs 523-531

(5) “Methanol Gasoline Blends in New Zealand”, W.G. Dyer, BP Zealand Limited, Proceedings of the IV International Symposium on Alcohol Fuels Technology, Brazil, October 1980, Volume 2, pgs 533-540

(6) “Road Trials to Assess the Hot Weather Driveability Characteristics of Gasoline Containing Oxygenates in European Cars”, SAE 831706, F.H. Palmer (BP Oil) & A. Tontodonati (ENI), SAE 1983

(7) “Engine and Vehicle Concepts for Methanol-Gasoline Blends, SAE 831686, Holger Menrad, Volkswagen Research, Bernd Nierhauve, Aral AG, Germany, 1983

(8) “Vehicle Operating Expereince with Methanol as a Substitute for Petrol and Diesel”, SAE 830899, R.J. Joyce, et.al., Liquid Fuels Trust, New Zealand, 1983

(9) “ALCOHOL FUELS: THE LAST TEN YEARS AND THE NEXT TEN YEARS’, VII International Symposium on Alcohol Fuels, Paris, October 1986, pgs 9 -35

(10) “A Review of the Study on Alcohol Fuels for Automotive Engines’, SAE 890433, Chen Xiaofu, Shanghai Automobile and Tractor Research, Shanghai, China, 1989

(11) “Compatibility of Fuel-Handling Rubbers with Gasoline/Alcohol Blends”, by A. Nersasian of DuPont, Elastomerics, October 1980

(12) “Effects of Mixtures of Gasoline with Methanol and With Ethanol on Automotive Elastomers”, SAE 800786, Ismat A. Abu-Isa, General Motors Research Lab, 1980

(13) “Effects of Methanol/Gasoline Mixtures on Elastomers”, SAE 840411, Ismat A. Abu-Isa, General Motors Research Lab, 1984

(14) “Effects of Fuel Exposure on Physical Properties of Selected Plastics”, SAE 900632, R.J. Pierce and P. Moses, Dow Chemical, 1990

(15) “Physical Property Considerations for Engineering Plastics and Elastomers in the Alternative Fuel Environment”, SAE 900631, J. Schindewolf and D.R. Currie, DuPont Automotive Products, 1990

(16) “Fuel-Alcohol Permeation Rates of Fluoroelastomers, Fluroplastics, and Other Fuel Resistant Materials”, SAE 920163, W.M. Stahl & R.D. Stevens of DuPont. February 1992

(17) “Leak Prevention of Reformulated Fuels and Oxygenates”, DuPont Elastomers, H-42581, October 1993

(18) “Fuel Hose Permeation of Fluoropolymers”, SAE 930992, D.R. Goldsberry, E.I. Du Pont de Nemours, 1993

(19) “Development in fuel hoses to met changing environmental needs”, J.R. Dunn, Rubber World, March 1, 1994

(20) “Viton – Excelling in Modern Automotive Fuel Systems”, DuPont Dow elastomers, H-82107, March 1999

(21) “A Rational Approach to Qualifying Materials for Use in Fuel Systems”, SAE 2000-01-2013, M.J. Harrigan Sr., Ford Motor, et.al., June 2000

(22) SAE J1681- 1993, Surface Vehicle Recommended Practice: Gasoline/Methanol Mixtures for Material Testing, Sept 1993

(23) SAE J1681-2000, Surface Vehicle Recommended Practice: Gasoline, alcohol, and diesel fuel surrogates for materials testing, issued 2000

(24) Federal Register / Vol. 76, No. 240 / Wednesday, December 14, 2011 / Notices; Regulation of Fuel and Fuel Additives: Modification to Octamix Waiver. Spirit of 21st Century LLC submitted a request to U.S. EPA to modify the waiver. The new request seeks approval on an alternative corrosion inhibitor, TXCeed, to be used within Texas Methanol’s gasoline-alcohol fuel, also known as OCTAMIX. EPA asked for comments on the petition.

(25) Federal Register /Vol. 77, No. 13 / Friday, January 20, 2012 /Notices; Regulation of Fuel and Fuel Additives: Modification to Octamix Waiver, Baker Hughes submitted a request to U.S. EPA to modify the waiver. The new request seeks approval on an alternative corrosion inhibitor, TOLADTM MFA–10A, to be used within Texas Methanol's gasoline-alcohol fuel, also known as OCTAMIX. EPA asked for comments on the petition.

(26) "Flammability and Toxicity Tradeoffs with Methanol Fuels", SAE 872064, Paul A. Machiele, US EPA, 1987

(27) "A Health and safety Assessment of Methanol as an Alternative Fuel", by Paul A. Machiele, US EPA, Methanol As An Alternative Fuel choice: An Assessment, edited by Wilfrid L. Hohl, 1990

(28) "Determination of a Range of Concern for Mobile Source Emissions of Methanol", Craig Harvey, EPA/AA/TSS/83-6, U.S. Environmental Protection Agency, July 1983

(29) "Environmental Impact of Methanol From Methanol-Blended Fuel Emissions", Z.L.Chen and N.B.Bai, Institute of Environmental Chemistry, People's Republic of China, International Symposium on Alcohol Fuels, 1986

(30) "Technical Problems Associated with the Application of Methanol-Gasoline Blend Fuel (M15) in Truck", Z.Ning, Shanxi Research, Institute of Traffic Science, People's Republic of China, International Symposium on Alcohol Fuels, 1986

(31) "Exhaust from Dongfend Trucks Fueling Methanol/Gasoline Blended Fuel (M15) and Its Impact on the Atmosphere", Z.Ruilan, L.Xiulan, B.Naibin, Institute of Environmental Chemistry, Academia Sinica, People's Republic of China, International Symposium on Alcohol Fuels, 1986

(32) "Health Effects of Oxygenated Fuels", Maria G. Constantini (Health Effects Institute), Environmental Health Perspectives Supplements 101 (Suppl. 6): 151-160 (1993)

(33) "Acute Toxicity of Gasoline and Some Additives", E. Reese and R. D. Kimbrough, Environmental Health Perspectives Supplements 101 (Suppl. 6): 115-131 (1993)

(34) "Methanol as an alternative transportation fuel in the U.S.: Options for sustainable and/or energy secure transportation", L.Bromberg and W.K. Cheng, Sloan Automotive Laboratory, Massachusetts Institute of Technology, November 28, 2010

(35) Assessment of Costs and Benefits of Flexible and Alternative Fuel Use in the U.S. Transportation Sector, Technical Report Seven: Environmental, Health and Safety Concerns, U.S. Dept. of Energy, October 1991

(36) "Technical Support Document: Toxicology Clandestine Drug Labs/Methamphetamine, Volume 1, Number 10, METHANOL", C. Saloks and K. Black Siegal, OHEAA, Sept 24, 2003

(37) "Evaluation of the Fate and Transport of Methanol in the Environment", Malcolm Pirnie, Inc., Oakland, Calif., January 1999

(38) "Car Makers Look To Methanol as Fuel of the Future", Stella Dawson(Reuters), Philadelphia Inquirer, June 18, 1989

(39) "The Methanol Story: A Sustainable Fuel for the Future", R.J. Nichols, Ford Motor Company, Journal of Scientific & Industrial Research, Vol. 62, January-February 2003, pp 97- 105

(40) Chinese Automaker: BYD 2010 Vehicle Owners Manual

(41) Chinese Automaker: Chery A3 2009 Vehicle Owners Manual

(42) Methanol Blending in China -Trip Report, Gal Luft, IAGS (International Analysis for the Global Security), May 2012