



Guidelines and Best Practices For Blending Mid-level Ethanol Blends

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INTRODUCTION

The Renewable Fuels Association (RFA) is the national trade association for the U.S. fuel ethanol industry. Membership is comprised of numerous ethanol producers as well as suppliers to the ethanol industry and other interested parties. Founded in 1981, the RFA's primary objective is to promote public policy initiatives that increase the market for fuel grade ethanol produced from a variety of feedstocks including grains, agricultural wastes, and cellulosic biomass sources.

As the ethanol industry has grown, so too has the Renewable Fuels Association's areas of responsibility to its membership. Today the RFA not only focuses on legislative and regulatory issues but also on research, technical issues and market development. The RFA maintains several committees and task groups to address industry needs. These committees include a committee to address technical issues and to assist with technical industry publications (such as this one). In addition, there are plant and employee safety, environmental, and cellulosic committees monitoring efforts in each of these respective areas. Committees and task forces are comprised of representatives of RFA member companies, staff, and when necessary, technical consultants and other interested stakeholders. The RFA provides support for educational outreach programs through its research and education arm, the Renewable Fuels Foundation.

The RFA promotes the use of fuel grade ethanol in all its various applications. Today, fuel ethanol is blended in virtually all of the nation's gasoline. This includes the more traditional fuel blends of E10 (90% gasoline/10% ethanol), reformulated gasoline (RFG), and oxygenated fuels, as well as developing markets such as E85 (15% gasoline/85% ethanol) and mid-level ethanol fuel blends. This document focuses on the product quality and integrity of mid-level ethanol blends an issue of utmost importance to the RFA and its members. To promote the production and use of quality fuels, the RFA has developed this blending guideline and best practices document to serve as a condensed technical reference for ethanol blenders and other interested parties who need such information.

For an expanded discussion of the importance of specifications and properties of fuel grade ethanol, please refer to RFA Publication #960501, "Fuel Ethanol-Industry Guidelines, Specifications and Procedures." RFA technical publications and reference materials are available on the RFA website at: www.ethanolrfa.org.

Guidelines and Best Practices

For Blending Mid-level Ethanol Blends

Today's fuel choices are limited to E10 (10% ethanol by volume) and E85 (85% ethanol by volume). With volatile energy costs affecting all Americans, offering flex-fuel vehicle (FFV) owners more choices at the fuel pump makes sense. One way to accomplish this goal is for retail fuel station owners to purchase and install a multi-product fuel dispenser, commonly referred to as a "blender pump." Blender pumps utilize existing fuels available at the station to offer consumers ethanol blended fuels *between* 10% and 85% ethanol, commonly referred to as mid-level ethanol blends.

Much of the expanded use of ethanol as a transportation fuel can be attributed to consumer interest in replacing imported oil. On December 19, 2007, the United States Congress made a giant step toward energy independence by passing the Energy Independence and Security Act of 2007, which includes policies such as the Renewable Fuels Standard to increase the use of renewable fuels, including ethanol. Increasing the availability of "mid-level ethanol blends" will help to achieve these goals.

Introduction of new mid-level fuel blends is expected as the marketplace incorporates additional biofuel volumes. Mid-level ethanol blended fuels are fuels containing above 10% and below the allowed 70% minimum ethanol content for E85 and are being developed and marketed to provide consumers with more fuel choices at the retail level. They are described as fuel blends with varying levels of ethanol and gasoline called "E XX," where the letter E stands for "ethanol volume percent" and the "XX" indicates the minimum ethanol content contained in the blend, with the balance of the fuel being a hydrocarbon such as unleaded gasoline. Today, these mid-level ethanol blends containing more than 10% ethanol by volume are restricted for use in flexible fuel vehicles (FFVs).

Flex-Fuel Vehicles

The idea of using ethanol as a transportation fuel dates back to the 1880's with Henry Ford designing his automobiles to run on ethanol. The first flex-fuel vehicle available was the 1908 Model T, a far cry from the sophistication of today's automotive technology. Manufacturers began offering flex-fuel vehicles in model year 1998. Many vehicle manufacturers currently offer vehicles that are capable of operating on 100% gasoline, E85, or any mixture of the two, such as mid-level ethanol fuel blends. These vehicles are called flex-fuel vehicles (FFV) or variable fuel vehicles (VFV). Mid-level ethanol blends are a newly offered fuel for use in FFVs, developed to complement E85 fuel sales.

In 2009, there are more than eight million FFVs on the road and by 2012 domestic automobile manufacturers have committed to produce 50% of their current models with the flex-fuel option.

There are several ways to determine if a vehicle is an FFV:

- The inside of a vehicle's fuel door will typically note E85 compatibility with a sticker.
- Since September of 2006, auto manufacturers are required to place a label inside the fuel door and to badge the rear of the vehicle. Some manufacturers actually added yellow gas caps for additional recognition.
- Flex-fuel capability is noted in the owner's manual and encoded in the vehicle's identification number (VIN).

FFVs are growing in demand as consumers want a choice in fuels and desire to support domestically grown transportation fuels. A full list of FFV models for the past and current model years is available from the Department of Energy's website:

http://www.afdc.energy.gov/afdc/vehicles/flexible_fuel_availability.html

Fuel Regulation Overview

Transportation fuels are regulated by the U.S. Environmental Protection Agency (EPA) and state governments. Fuels that consist of a minimum of 90% unleaded gasoline and maximum of 10% ethanol by volume are considered "gasoline" and gasoline regulations can be found in the Code of Federal Regulations, Title 40, Part 80. Transportation fuels that contain greater than 10% ethanol, such as E85, are considered alternative fuels by EPA.

Today, blends containing 20, 30, and up to 85% ethanol content are available to FFV owners wanting the choice of ethanol content in their fuel. Mid-level ethanol blends are to be used only by FFVs, which are vehicles designed to run on E85, gasoline, or any blend of the two. More information on EPA requirements for alternative fuels can be found here:

<http://www.epa.gov/oms/consumer/fuels/altfuels/altfuels.htm>. Fines and/or penalties for fueling a non-FFV with a mid-level ethanol blend can be assessed to the fuel retailer in amounts in excess of \$10,000 per offense. Additional guidance has been provided by EPA on the required use and marketing of alternative fuels through correspondence to the American Petroleum Institute on July 31, 2008, a copy of which can be found in the Appendix.

There are many state initiatives to increase the availability of mid-level ethanol blends in areas such as Kansas, South Dakota, Missouri and Minnesota. An example of a mid-level ethanol blends program in the State of Kansas can be accessed here:

http://www.ksda.gov/weights_measures/content/215. These programs are designed to build the education and experience for alternate fuel blends with both fuel distributors and consumers. The RFA Market Development team is available to assist in developing these programs, and can be reached at info@ethanolrfa.org or by calling (402) 391-1930.

Fuel Quality

Fuel quality is a vital aspect in motor fuels in order to ensure acceptable operation for all types of vehicles on the road in varying climates and seasons. Fuel quality guidelines that list the fuel parameters, such as the content and make-up of fuels to ensure proper combustion and performance, are referred to as fuel specifications. ASTM International has traditionally developed and published fuel specifications for use in the United States for unleaded gasoline, E10 (D4814) and E85, referred to as Ed75- Ed85 (D5798); these specifications are available at www.astm.org. Mid-level ethanol blended fuels do not meet the criteria as listed in any of the current ASTM fuel specifications and rely on the practice of blending two motor fuels together that would independently meet current ASTM and together meet vehicle performance requirements. ASTM specifications for such mid-level fuel blends are expected to be developed over time.

In the absence of federal or state specifications, guidelines for delivering quality mid-level ethanol blended fuels must be developed with a thorough knowledge of fuels available and the development of a program based on quality. With the majority of all fuels sold in the U.S. already containing a small percentage of ethanol, fuel blenders at both the retail and terminal level will need to develop quality programs and communication in order to convey fuel properties. Providing a consistent, high quality fuel to the marketplace should be a priority.

Fuel Quality Recommendation

The RFA recommends that mid-level ethanol fuel blends be created by the blending of:

- Gasoline meeting the requirements of ASTM D 4814 Standard Specification for Automotive Spark-Ignition Engine Fuel
 - Unleaded gasoline (E0), or
 - E10 (10% ethanol blended gasoline)

And, either

- E85 (85% denatured ethanol) meeting ASTM D 5798 Standard Specification for Fuel Ethanol (Ed75- Ed85) for Automotive Spark-Ignition Engines, or
- Fuel grade ethanol (denatured ethanol) meeting ASTM D 4806 Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel.

The following guidelines for fuel quality may also be used:

Parameter	Specification Limit
Ethanol content	Consistent with posting Consistent with E “XX” Posted value
Vapor Pressure, psi	Vary seasonally with: Minimum limit in ASTM D 5798 Maximum limit in ASTM D 4814
Sulfur, mg/ kg, maximum	80
Solvent washed gum, mg/100ml, maximum	5
Unwashed gum content, mg/ 100ml, maximum	20
Appearance, 70°F	Visibly free of suspended or precipitated contaminants

Fuel quality must be monitored with an ongoing quality assurance program. Periodic inspections should be conducted to monitor the equipment’s performance and fuel quality. The RFA publishes a guideline for Quality Assurance and Quality Control, available at www.ethanolrfa.org.

Fuel Additives

Gasoline is subject to EPA's gasoline detergency requirements. The RFA recommends that gasoline ethanol blends contain the appropriate detergent/deposit control additive at levels to provide detergency performance comparable to gasolines. Historically, concerns have been expressed regarding a lack of solvency of some fuel additive chemical formulations with ethanol. Fuel additive manufacturers should be consulted and solvency confirmed for the ethanol blend intended. The fuel blender should also confirm they are utilizing a properly registered detergent/deposit control additive that is in compliance with EPA regulations.

The RFA recommends that its ethanol producing member companies treat their ethanol with a corrosion inhibitor to ensure that any final blend is properly treated for corrosion protection. Blenders should check with their ethanol supplier if they have any questions regarding the type or level of corrosion inhibitor used.

Retail Blending Strategies

The evolution of fueling automobiles has expanded beyond the service station to modern day convenience stores offering more than just fuel. A second evolution has occurred with fuel dispensing technology that includes a video screen for advertising, pay at the pump capability, anti-theft technology, and the added capability of blending fuels at the dispenser. The ability to offer multiple fuel choices to consumers provides a potential new revenue source for retail station and convenience store owners.

“Blender pumps” are known by fuel dispenser manufacturers as multiple product fuel dispensers. Fuel dispenser technology available today has the ability to combine multiple fuel streams at the dispenser in pre-programmed ratios, providing much needed flexibility to station owners with limited fuel storage. These dispensers are designed to deliver a pre-set ratio of ethanol and gasoline with safeguards in place to ensure blend strategies are consistently met.

New fuel blending strategies require planning. When blending multiple fuels together, one should consider the ultimate fuel blend target and how to reach that target with the quality and composition of the fuels available. A strategy for handling the variability in ethanol and gasoline content in fuels being delivered must be developed as well as design and implementation of the physical blending mechanism that will be used. Whether the fuel blending occurs at the terminal or retail location, or both, must be included in the blending strategy. If the gasoline available for blending already contains 10% ethanol content, that volume must be adjusted for in the final targeted blend, just as the exact ethanol content must be known if nominal E85 is being used as the ethanol source. Additionally, for retail blending the fuel dispenser must be programmed to cease operation if an insufficient fuel volume is available in the fuel inventory to ensure blending targets are met. Remember, E85 may be seasonally adjusted for volatility, causing the ethanol content to vary from a winter minimum of 70% to a summer minimum of 79%. Unleaded gasoline may also vary in volatility and ethanol content seasonally.

The following equations will help determine proper blend ratios for the various fuel blends:

EXAMPLE:

If an E10 fuel (90% unleaded/ 10% ethanol) is being used as the base gasoline, and an E85 fuel (85% fuel ethanol/ 15% unleaded) is being used as the ethanol component, then the following equation should be used to predict the number of gallons used to make the various blend ratios:

$$\text{Equation: } (E10 * E10V) + (E85 * E85V) = (EXX * EXXV)$$

Where, E10 base gasoline contains 10% ethanol content in unleaded, and E10 V= volume in gallons of E10, and the E85 component contains 83% ethanol content in the E85 fuel, and E85 V= volume in gallons of E85 fuel, resulting in an EXX blend of V gallons = XX is the target ethanol volume percentage and EXXV is the final volume of mid-level blend fuel.

$$\text{Equation: } (10 * E10V) + (83 * E85V) = (EXX * EXXV)$$

Example batch calculations:

Ethanol Concentration	Unleaded Gasoline Gallons (E10)	Ethanol Concentration In E85	E85 Gallons	Target Concentration	Resulting Gallons
10	1,726	83	274	E20	2,000
10	3,452	83	548	E30	4,000
10	1,714	80	286	E20	2,000
10	3,428	80	573	E30	4,000
10	1,692	75	306	E20	2,000
10	3,384	75	616	E30	4,000

There may be company policies and product branding agreements that provide guidelines or requirements for all fuels offered at the retail level. A review of any contractual requirements is pertinent prior to the addition of any new fuel.

Installations and Conversions

Successful blending programs utilizing new equipment installation or conversion of existing equipment depend on thorough preparation and planning for the entire fuel system. The investigation and design of the wetted fuel system starts with a review of the flow of the fuel from receipt through retail delivery. This review applies to the initial handling point at the terminal, through the distribution and transport system, and ultimately to the end point, the retail point of sale. Documentation of the findings and changes made during the system review may prove beneficial for the station owner's future reference. Equipment suitable for E85 fuel dispensing may be suitable for use with mid-level ethanol blends dispensing; equipment manufacturers can assist with this determination.

Helpful information for selecting new equipment for mid-level ethanol blends is available from the Petroleum Equipment Institute (PEI), <http://resource.pei.org/altfuels/guide.asp>. This website compiles fuel dispensing components subdivided into each major equipment category and fuel design.

Tanks

The investigation process for fuel storage at both terminal and retail locations must include a thorough inspection and investigation of tank material construction. Tank inspections have been used successfully when contemplating conversion of existing tanks for new fuel service. These investigations can identify any residual gasoline contaminants such as lacquers and tars that may

have been left behind from years of gasoline handling. Any gasoline residue should be removed prior to the introduction of ethanol blended fuels.

Historically, mild steel above ground tanks have been used with both ethanol and ethanol-gasoline blends of varying concentrations at terminals. Underground tanks at the retail station may be made of mild steel or fiberglass reinforced plastic. While these tanks have been used successfully with up to 10% ethanol blends, they may not be suitable for higher blend concentrations above E10. These blends may require a tank constructed of chemically resistant resin or a double walled construction. The interior of some older steel tanks may have been lined to prevent small leaks or change in product service. In particular, general epoxy or polyester resin based materials used in the late 1970s and earlier 1980s are not compatible with gasoline/ethanol blends. If a tank has been re-lined, the lining material should be confirmed as compatible. For new tank lining, the manufacturer should recommend a liner compatible with varying levels of ethanol content. If the equipment documentation cannot be consulted for compatibility information, the equipment manufacturer should be consulted.

Underground storage tanks must be properly labeled as to the contents of the tanks. Proper labeling provides a visual aid for fuel delivery personnel to ensure fuel is delivered to the appropriate tank. A fill connection suggested labeling scheme is listed in API Technical publication #1637, "Using the API Color- Symbol System to Mark Equipment and Vehicles for Product Identification at Service Station and Distribution Terminals," available from www.api.org.

There is leak detection and automatic tank gauge equipment suitable for ethanol blended fuel use. The probes, sensors and floats of these systems may be different from older gasoline designed equipment. Suitable equipment selection and proper installation ensures proper operation and mitigation of fuel quality and environmental issues that are associated with all fuel handling. Be sure to use an alcohol compatible water finding paste; these products are readily available from petroleum equipment suppliers.

Pumps

Pump design for fuel handling systems is dependent on designed flow rates, system size and construction. The preferred materials for the inner workings of the pumps, pump seals and packing materials are carbon and ceramic. Teflon impregnated packing materials are recommended for packing construction. Petroleum equipment suppliers should be able to determine if existing terminal pumps are compatible with the desired fuel blends. These same materials may also be used for above ground and submersible pump components.

Fuel Dispensers

Fuel dispensing equipment includes the dispenser pump, hoses, swivels, nozzles and a host of miscellaneous supporting equipment. A review of the entire fuel dispensing system can ensure a successful offering of new fuel blends. This review should include equipment design and material compatibility. Consideration must also be given to the accurate and consistent

dispensing of all fuel blends. Keep in mind that the compatibility of mid-level ethanol blends can differ from E10.

Dispenser design is critically important. The greatest flexibility in retail fuel product offering utilizes a multiple hose-multiple blending valve pump configuration that is currently available from dispenser manufacturers. This type of design is typically referred to as a 3+1 type of dispenser, allowing various products (3) to be dispensed through independent systems from other fuels (1). This type of dispensing design, to dispense multiple ethanol blends such as E20, E30, and E85 through a common hose, has been used successfully. This type of configuration provides assurance of proper fuel dispensing, especially for the volume that remains in the fuel dispensing hose, which in some cases can be up to 0.3 gallons.

The RFA recommends, and some states may require, that blends with greater than 10% volume ethanol, such as E20, E30 and E85, be dispensed through separate dispensing hoses from E10 and E0 unleaded gasoline blends.



Dispenser compatibility depends on the construction of the working parts of the dispenser. The mechanical parts of a dispenser include various gaskets, solenoid valves, sealants, piping, and the pump or meter. New equipment design and installation may provide the most reassurance for system capability to handle new fuel blends. However, conversion of existing equipment has been done successfully and may be appropriate after a thorough system review and confirmation of suitability of all the components. There are field kits available for the conversion of fuel dispensers to ethanol-compatible materials through Clean Fuel USA, www.cleanfuelusa.com.

Regulatory oversight programs require that fuel dispensers be accurate. A common type of required certification for fuel dispensers is the National Institute of Standards and Technology (NIST) National Type Evaluation Program (NTEP). This certification provides acceptability standards for various metering equipment including fuel dispensers. Information on the NTEP certification can be found at <http://www.ncwm.net/ntep/>. Further information on standards for fuel dispensing and related equipment is listed in the NIST Handbook 44 (most current version 2009) and is available at <http://ts.nist.gov/WeightsAndMeasures/Publications/H130-09.cfm>.

When first converting to any new fuel dispensing program, it is advisable to recalibrate meters after pumping a few thousand gallons to ensure that the change of product has not caused any meters to over or under dispense.

Filters

Filters and screens used at both the terminal and retail level provide fuel quality assurance from commonly found dust and loose particles. A 10 micron (nominal) filter is recommended and may be required for the retail level in some states. A #40 mesh screen placed in the transfer line at the terminal has also been used successfully for bulk transfer operations.

When retail stations first convert to ethanol blended fuels, ethanol in the fuel blend may loosen built up gasoline contaminants such as lacquers and tars that may have been left behind from years of gasoline handling. This may result in the need for increased filter changes shortly after conversion. Having extra filters on hand prior to any new fuel introduction will prove valuable to uninterrupted operations. Once the system is clean, filter life is expected to return to normal maintenance levels. For safety purposes, the electric breaker for the fuel pump should be switched to the off position during filter changes.

Hoses/ Nozzles

There are fuel dispensing hoses compatible with all variations of ethanol and gasoline fuel blends. For future flexibility, hoses compatible with ethanol content as high as 85% ethanol should be purchased. Breakaways, an important safety feature on fuel dispensing hoses, should also be compatible. The nozzles for retail gasoline dispensers must indicate compatibility with mid-level ethanol blended fuels and nozzles that are compatible with E10 may not necessarily be suitable for use with fuel containing greater than 10% ethanol. Ethanol blends have been dispensed through all major brands of nozzles for a number of years without incident. Consultation with the equipment manufacturer on materials compatibility is advised.

Containment

Product overflow systems and spill containment equipment should also be reviewed for compatibility with ethanol blended fuels. Not only should consideration be given to the effect of ethanol on the equipment but also with the mix of products that may be combined in a containment system. Remember that ethanol is completely soluble with water and any ethanol/gasoline/water system may function differently than those systems that separate only gasoline/water. Containment capabilities at the retail fuel station are traditionally limited and a well-thought out plan is the best defense in the event of an incident.

Materials Compatibility Information

Ethanol blended fuels have been successfully and safely handled in the marketplace for more than 20 years. Throughout this long history, many best practices have been developed in the area of materials compatibility. High ethanol content fuels more closely resemble polar solvents than hydrocarbons and thus necessitate a review of the wetted system parts for compatibility.

As is the case with any new equipment purchase, fuel system equipment intended for use in handling, storing or dispensing mid-level ethanol blended fuels must be verified for appropriateness, including suitable design and compatible material construction, prior to use. Most, if not all, materials used in retail gasoline dispensing systems are compatible with 10% ethanol blended gasoline (E10). Equipment used in the dispensing of greater than 10% volume ethanol blended fuels (e.g. storage tanks, fuel dispensers, piping, hoses, etc.) must be designed for higher ethanol content fuels. Materials described as “E85 compatible” or “alcohol resistant” are acceptable. For ease of use, the following table has been developed to highlight materials that have been used successfully as well as a column for materials that may give cause for compatibility concern.

Fuel Ethanol General Compatibility Guide				
	Compatible		Non Compatible	
Metals:	Unplated Steel	Bronze	Zinc	Brass
	Stainless Steel	Black Iron	Copper	Some Aluminums
	Nickel Plate		Lead	Lead Alloys
			Terne Plate	Galvanized Surfaces
Elastomers/ Plastics:	Teflon	Viton	Natural Rubber	Cork
	Polypropylene	Nitrile	Polyurethane	Leather
	Thermo Plastic Pipe	Buna N	PVG	Acrylic
	Neoprene Rubber	Nylon	Some Thermoset Plastics	
	Thermoset Reinforced Fiberglass			

Phase Separation and Water Concerns

As with all fuel handling systems, good housekeeping and effective storage and handling system maintenance are the key to any successful fuel operation. Removal of existing water and prevention of new water contamination is a key step. All potential water entry points must be effectively designed to preclude water introduction such as proper water runoff, tightening fill caps and installing covers over vapor vents. Water mitigation steps should also be taken for storage tanks and fill box equipment. Ethanol is infinitely soluble in water and the sensitivity of gasoline/ethanol blends to phase separate is greatly affected. Day to day condensation and

humidity are typically not an issue for product inventory that is continuously being dispensed and replenished. However, there is no publically available data to provide more precise information on this topic.

Again, alcohol-compatible, water finding pastes or indicators should be used for all ethanol fuel blends. These pastes are “modified” or labeled for use with oxygenated fuels and give clear indication of any system concerns with water entry.

Seasonal Inventory Control

As part of the marketing plan for all fuel blends, a product quantity monitoring program helps to ensure successful handling and delivery. Both unleaded gasoline and E85 vary in vapor pressure seasonally to improve the cold start and warm up performance in automobiles as well as to mitigate environmental concerns due to fuel volatility. Slow product turnover at the retail level could lead to inadequate vapor pressure fuel being delivered unknowingly to consumers. Consideration must also be given to fuel quality regulations for your area.

Fuel Dispenser Labeling

Federal and state motor fuel labeling and posting requirements are designed to protect and provide consumers with important information pertaining to the fuel’s characteristics. A review of these requirements is highly recommended prior to new retail fuel offering. Following labeling requirements and providing a consistent quality fuel is critical to a successful program.

The Federal Trade Commission, as listed in the Code of Federal Regulations Title 16, Part 306, requires appropriate labeling of alternative liquid motor fuels. Alternative liquid motor fuels are defined as mixtures containing a maximum of 85% and not less than 70% denatured ethanol and/or other alcohols. Mid-level ethanol blends are not specifically covered by this regulation; however RFA recommends following the appearance guidelines for label size, color and position as listed for alternative fuels identical to E85. Additionally, there are requirements for determining and posting the automotive fuel rating for the fuel being dispensed, to include the following wording: “To determine automotive fuel ratings for alternative liquid automobile fuels, you must possess a reasonable basis, consisting of competent and reliable evidence, for the % by volume of the principal component of the alternative liquid fuel that you must disclose.” Consistency of the fuel being delivered is important to consumers and regulators.

The RFA recommends that if “E20” appears on the fuel dispenser label, then the fuel sold under that label should contain a minimum of 20% ethanol content by volume, excluding the denaturant and any other incidental hydrocarbon addition.



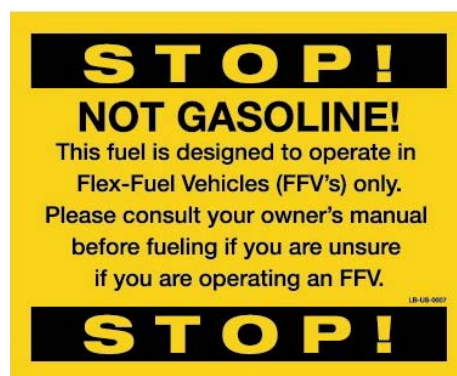
Most states adopt fuel labeling requirements as listed in NIST Handbook 130, “Engine Fuels, Petroleum Products, and Automotive Lubricants Regulation.” Handbook 130 states that the type of oxygenate must be disclosed using the word “with” or “containing”. The most current NIST Handbook 130 (2009) also describes labeling for E85 as meeting 16 CFR 306 and includes a label “For Use in Flexible-Fuel Vehicles (FFV) Only”.

(<http://ts.nist.gov/WeightsAndMeasures/Publications/H130-09.cfm>) The labeling position and size/type is also clarified. NIST Handbook 130 provides specific guidance in section G. “Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulation,” Section C pertaining to the Classification and Method of Sale of Petroleum Products, lists the labeling and certification requirements:

- When gasoline, gasoline oxygenate blends, or E85 are sold, an invoice, bill of lading, shipping paper or other documentation must identify the quantity, the name of the product, the particular grade of the product, the applicable automotive fuel rating, oxygenate type, and content (if applicable), the name and address of the seller and buyer, and the date and time of the sale.
- Method of Retail Sale. Type of oxygenate must be disclosed. All automotive gasoline or automotive gasoline-oxygenate blends kept, offered, or exposed for sale, or sold at retail containing at least 1.5 mass % oxygen shall be identified as “with” or “containing” (or similar wording) the predominant oxygenate in the engine fuel. For example, the label may read “contains ethanol.”
- A label shall be posted which states “For Use in Flexible-Fuel Vehicles (FFVs) Only.” – This information shall be clearly and conspicuously posted on the upper 50% of the dispenser front panel in a type at least 12.7 mm (1/2 in) in height, 1.5mm (1/16th in) stroke (width of type).

For mid-level ethanol blends, labels may depict the amount of the alternative fuel content expressed as a minimum percentage. An example would be “E20” or “e20”. There are states that prohibit the display of an octane rating of alternative fuels.

The RFA discourages any advertising or labeling that would encourage or suggest the use of these blends in non-flex-fuel vehicles. Also, there should be no advertisement of any exaggerated fuel performance benefits.



Safety Considerations

The goal of all parties involved in the fuel distribution chain is to provide a safe, consistent and reliable source of fuel for consumers. Safety considerations should be discussed and addressed before and routinely thereafter, as ethanol and gasoline are flammable materials. Any safety equipment upgrades, additions or modifications needed to provide an effective response to any incident should be available before the new fuel blends are present.

Fire Related Emergencies

Ethanol blended fuels present the same type of flammability hazard as other transportation fuels, however ethanol's polar solvent nature may be a new consideration. A review of the fire response equipment at all levels of the distribution chain will ensure the appropriate tools are available in the event of an emergency. This review includes a check of appropriateness of the larger response equipment such as structural protection that includes fire fighting foams as well as the small incident response tools such as fire extinguishers.

Ethanol blended fuels with greater than 10% ethanol require the use of a Polar Solvent or Alcohol Resistant (AR) type of foam, commonly known as an AR- AFFF. Traditional AFFF foams have limited to no ability to extinguish fire emergencies when the ethanol content is above 10% by volume. AR type foams work on all alcohol variations of ethanol blended fuels and would be the best use of fire response equipment. It should be mentioned that dry chemical fire extinguishing agents may also work on ethanol blended fuels; however the dry chemical manufacturer must be consulted for appropriateness.



The RFA has been an instrumental member of the Ethanol Emergency Response Coalition (EERC). Together, RFA and EERC have produced a training package for those with a background in hazmat safety. "Ethanol: Response Considerations," includes an instructor's guide and student manuals to create interactive workshops, with supporting videos and other presentation materials. This diverse training package will help to provide a complete look at all the considerations and issues to ethanol related fires, spills and other emergencies. The package will also include guidelines for fire departments that have ethanol production facilities in their communities.

A second video, "Responding to Ethanol Incidents," provides the necessary guidance for foam selection to address ethanol blended fuel fires. The training package and videos are available for free download from the RFA website, www.ethanolrfa.org. Another reference point for ethanol specific safety information is the EERC's website, www.ethanolresponse.com. This website holds a library of emergency and environmental information to help with both

education and preparedness in the first response community when responding to ethanol related emergencies. There are contacts, Material Safety Data Sheets (MSDS), and technical bulletins available.

Safety training for distribution, retail, and emergency response personnel should be included specifically for ethanol blended fuels. Ethanol specific training provides the communication link between all parties to ensure an effective response to any emergency that should arise.

Legal Considerations

Most states, and even some municipalities, adopt motor fuel handling guides and recommendations from a fire emergency response perspective through the legislative adoption of model regulations as developed by the National Fire Protection Association (NFPA) or International Code Council. Examples of model regulations are the NFPA 30 Flammable and Combustible Liquids Code and the NFPA 30A Code for Motor Fuel Dispensing Facilities and Service Garages. A third party safety evaluation of fuel dispensing equipment may be a requirement of the fire code. This evaluation is undertaken by nationally recognized testing laboratories such as Underwriters Laboratories Inc. (UL), or FM Global (FM). Fuel handling and dispensing facilities should follow all state and local fire codes, and where these codes have not been updated to reflect newly available technology or current business practices, an open line of communication with the local fire marshal or authority having jurisdiction provides the best avenue for understanding what regulations are in place for your location. As is the case with some new retail fuel dispensing equipment, a third party safety evaluation may not yet be complete. While this equipment is being evaluated, safety expectations for new fuel dispensing equipment should be discussed with the fire marshal or authority having jurisdiction.

The Occupational Safety and Hazard Administration (OSHA) also provides regulatory requirements for flammable and combustible liquids such as ethanol and gasoline in the Code of Federal Regulations 29, Part 1910.106. These requirements provide safeguards for protecting people and equipment.

Additional Information

Fuel Economy

Fuel economy is the comparison of engine performance in distance terms with energy usage (miles per gallon) and is influenced by many factors. The resulting loss of fuel economy due to the inclusion of 10% ethanol in gasoline is minimal when compared to all the factors affecting fuel economy. Excess cargo weight, vehicle condition and maintenance, proper tire inflation, use of air conditioning, consumer driving habits, climate related effects, and fuel composition produce similar, and in most cases greater impacts, on loss of fuel economy. In general, the fuel economy of most flex-fuel vehicles can be expected to decrease as ethanol content is increased due to the lower energy value of ethanol compared to gasoline. Engineering advances in fuel combustion and ignition technology are expected to reduce the fuel economy penalty while taking advantage of the increase in octane found in ethanol.

References

RFA Publication # 960501, Fuel Ethanol Industry Guidelines, Specifications and Procedures

RFA Publication # 040301, QA/QC Guideline

RFA Publication # 090301, E85 Fuel Ethanol Industry Guidelines, Specifications and Procedures

EPA publication 420-F-06-047, Alternative Fuels: E85 and Flex-fuel vehicles

Clean Cities publication, Flexible Fuel Vehicles: Providing a Renewable Fuel Choice, June 2008

API Publication # 1626, Storing and Handling of Ethanol and Gasoline/Ethanol Blends at Distribution and Service Stations

API Publication # 1637, Using the API Color-Symbol System to Mark Equipment and Vehicles for Product Identification at Service Station and Distribution Terminals

Appendix

Gasoline-Ethanol Blend Program Station/Store Operator Checklist

American Petroleum Institute letter to Bob Greco, July 31, 2008

Mid-level Ethanol Blend Program Station/Store Operator Checklist

Investigatory/Preparatory

- 1. Complete system overview and verification of material compatibility.
Include tank, piping, leak detection, tank gauge, and submersible pumps.
Include fuel dispenser, pump/ meter, hose, and nozzle.
- 2. Investigate tank water problems and correct. Review history of water problems and initiate any necessary corrective action.
- 3. Tight seals on fill caps and proper water runoff from man hole covers.
- 4. Remove water bottoms (if present). Check for tilted tanks.
- 5. Clean tank bottom, if necessary.
- 6. Check for proper operations of rain caps and vent lines.

Conversion Plan (before first delivery)

- 1. Equip pump or dispenser with 10 micron filter. (or "water slug" filter)
(Remember - SAFETY FIRST - SHUT OFF BREAKER)
- 2. Recheck for water bottoms and remove any present.
- 3. Issue alcohol compatible paste and discard any old incompatible pastes.
- 4. Procure proper pump labels.
- 5. Confirm any applicable accounting procedures.

First Delivery

- 1. Check for water. Water bottoms must be removed before first delivery of ethanol blends.
- 2. Follow normal delivery procedures and ensure that accurate tank gauge and dispenser readings are taken.
- 3. Verify (with transport driver) correct compartment for correct tank.
- 4. Pumps should be shut down during initial delivery. (check company policy)
- 5. Purge lines from tanks to dispensers. (check company policy)
- 6. Install required decals and if necessary change octane decals. Also repaint manhole covers to proper color code (e.g., API color code).
- 7. Fill tanks to at least 80% of capacity. Keep as full as possible for 7 to 10 days.
- 8. Test for water bottoms at the beginning of each shift for the first 48 hours after initial delivery.
- 9. Check for water bottoms daily.
- 10. Notify designated personnel if water is detected and have it removed at once.
- 11. Replace filters if pump/dispenser is running slow. Shut off system at breaker box.
- 12. Check pump calibration two weeks after initial load conversion



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 31 2008

FIRST CLASS MAIL

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

Bob Greco, Director
Downstream and Industry Operations
American Petroleum Institute
1220 L Street, N.W.
Washington, DC 20005-4070

RE: Gasoline Ethanol Blends

Dear Mr. Greco:

Introduction

The United States Environmental Protection Agency (EPA) has recently received a number of inquiries regarding whether it is legal for retail gasoline stations to sell gasoline blended with more than 10% ethanol for use in motor vehicles and non-road engines. While the EPA has previously noted its views on this issue, given these inquiries we believe it will be helpful to provide additional clarification and notice on the Agency's compliance assurance activities.

Fuel Sales

Gasoline containing more than 10% ethanol may cause damage to certain emissions control devices and systems and increased emissions from gasoline-only vehicles and engines.¹ For this reason, the Clean Air Act (Act) prohibits retail gasoline stations from selling gasoline blended with more than 10% ethanol for use in gasoline-only vehicles and engines. The Clean Air Act does not, however, prohibit retail gasoline stations from selling gasoline blended with up to 85% ethanol for use in flexible-fueled vehicles or engines.²

The Act prohibits any fuel manufacturer from: 1) selling motor vehicle gasoline unless the fuel is further registered with EPA, and 2) introducing into commerce any fuel for use in motor vehicles which is not substantially similar to any fuel utilized in the certification of any

¹ A "gasoline-only vehicle or engine" refers to a motor vehicle or nonroad engine that has been certified by EPA to meet emissions standards using gasoline containing up to 10% ethanol. See, for example, 40 C.F.R. § 86.094-2 and 40 C.F.R. § 90.107.

² A "flexible-fueled vehicle or engine" refers to a motor vehicle or nonroad engine that has been certified by EPA to meet emissions standards using E85 (85% ethanol and 15% gasoline), gasoline without ethanol, or any intermediate combination of gasoline and ethanol.

model year 1975, or subsequent model year, vehicle or engine. See Sections 211(a) and 211(f) of the Act, 42 U.S.C. §§ 7545(a) and (f).

To date, no person has registered a fuel containing more than 10% ethanol for use in gasoline-only vehicles and EPA has not allowed the introduction of such a fuel into commerce. Under the Act, an owner or operator of a retail gasoline station that blends gasoline with more than 10% ethanol is a fuel manufacturer. Thus, it is illegal for owners or operators of retail gasoline stations to sell gasoline blended with more than 10% ethanol for use in gasoline-only vehicles.

Tampering

The “tampering” provision of the Act prohibits any person from rendering inoperative emissions control devices or elements of design on a motor vehicle or nonroad engine that is subject to EPA regulations and also prohibits causing such acts. Since mis-fueling a gasoline-only vehicle or engine with gasoline blended with more than 10% ethanol may damage certain emissions control devices and systems, owners and operators of retail gasoline stations that blend gasoline with more than 10% ethanol, or that cause such blending, may be in violation of the tampering provisions of the Act. See Sections 203(a)(3)(A) and 213(d) of the Act, 42 U.S.C. §§ 7522(a)(3)(A) and 7547(d).

Compliance Assurance

The Act authorizes EPA to assess significant civil penalties for improper blending of fuel and for mis-fueling motor vehicles and nonroad engines. To ensure proper fueling, EPA suggests that retail gasoline stations that sell gasoline blended with more than 10% ethanol for use in flexible-fueled vehicles or engines affix labels in a conspicuous manner to all pumps dispensing this product to inform the public that 1) federal law prohibits the use of gasoline containing more than 10% ethanol in any motor vehicle or nonroad engine that is subject to EPA regulations, other than flexible-fueled vehicles or engines, and 2) using this fuel in any vehicle or engine that is not a flexible-fueled vehicle or engine may damage the vehicle or engine and void its warranty.

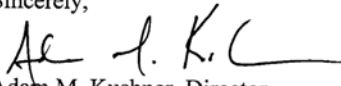
Precautions to restrict pump access to those persons who have flexible-fueled vehicles or engines, such as card lock systems, may also reduce the likelihood of violations. Pumps dispensing fuel containing greater than 10% ethanol that are set apart from other pumps dispensing gasoline, in combination with the previously mentioned precautions, could also help

prevent violations.

It should be noted, that EPA will be taking steps to investigate the retail distribution of non-compliant fuel.

If you have any questions regarding this matter, you may call Erv Pickell, Fuels Team Leader, at (303) 312-7152.

Sincerely,

A handwritten signature in black ink, appearing to read "A. M. Kushner". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Adam M. Kushner, Director
Air Enforcement Division