Designation: D7794 – 14

Standard Practice for Blending Mid-Level Ethanol Fuel Blends for Flexible-Fuel Vehicles with Automotive Spark-Ignition Engines[1]

This standard is issued under the fixed designation D7794; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice applies to the blending of automotive spark-ignition engine fuels with ethanol concentrations greater than those suitable for conventional-fuel vehicles and less than the minimum ethanol content specification limits of Specification D5798. These mid-level ethanol fuel blends are for use in flexible-fuel vehicles and are sometimes referred to at retail as "Ethanol Flex Fuel."

1.2 These mid-level ethanol fuel blends are only suitable for use in ground flexible-fuel vehicles equipped with spark-ignition engines. Flexible-fuel vehicles are designed to operate on gasoline or gasoline-ethanol blends that meet the requirements of Specification D4814, ethanol fuel blends that meet the requirements of Specification D5798, or any combination of these. In the United States, these vehicles are certified by the U.S. EPA as emissions compliant with these types of fuels.

1.3 The mid-level ethanol fuel blend shall be blended from either:

1.3.1 Denatured fuel ethanol conforming to the requirements of Specification D4806 with a reduced limit on inorganic chloride content that will ensure no more than 1 mg/kg inorganic chloride in the finished fuel and from spark-ignition engine fuel conforming to Specification D4814 (often at a distribution terminal or bulk plant), or

1.3.2 Ethanol fuel blends conforming to Specification D5798 and from spark-ignition engine fuel conforming to Specification D4814 (often at a retail site).

1.4 This practice describes the required procedures for blending various mid-level ethanol fuel blends for flexible-fuel vehicles at the bulk distribution point or retail/commercial delivery site. These requirements may be applied at other points in the production and distribution system when provided by agreement between the purchaser and the supplier.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D4806 Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel

D4814 Specification for Automotive Spark-Ignition Engine Fuel

D4815 Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C_1 to C_4 Alcohols in Gasoline by Gas Chromatography

D5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)

D5501 Test Method for Determination of Ethanol and Methanol Content in Fuels Containing Greater than 20% Ethanol by Gas Chromatography

D5599 Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection

D5798 Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines

D5842 Practice for Sampling and Handling of Fuels for Volatility Measurement

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.A0.02 on Oxygenated Fuels and Components.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

D5854 Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
D6469 Guide for Microbial Contamination in Fuels and Fuel Systems
D7319 Test Method for Determination of Existent and Potential Sulfate and Inorganic Chloride in Fuel Ethanol and Butanol by Direct Injection Suppressed Ion Chromatography
D7328 Test Method for Determination of Existent and Potential Inorganic Sulfate and Total Inorganic Chloride in Fuel Ethanol by Ion Chromatography Using Aqueous Sample Injection

2.2 *Other Standards:*[3]
16 CFR United States Code of Federal Regulations, Title 16, Part 306
40 CFR United States Code of Federal Regulations, Title 40, Part 86

3. Terminology

3.1 For general terminology, refer to Terminology D4175.

3.2 *Definitions:*

3.2.1 *automotive fuel rating, n*—the automotive fuel rating required under the amended Octane Certification and Posting Rule (or as amended, the Fuel Rating Rule), 16 CFR, Part 306.

3.2.1.1 *Discussion*—Under this Rule, sellers of liquid automotive fuels, including alternative fuels, must determine, certify, and post an appropriate automotive fuel rating. The automotive fuel rating for gasoline is the antiknock index (octane rating). The automotive fuel rating for alternative liquid fuels consists of the common name of the fuel along with a disclosure of the amount, expressed as a minimum percentage by volume, of the principal component of the fuel. For alternative liquid automotive fuels, a disclosure of other components, expressed as a minimum percentage by volume, may be included, if desired. This is applicable in the United States.

3.2.2 *conventional-fuel vehicle, n*—a vehicle designed to operate on spark-ignition engine fuel that complies with Specification D4814.

3.2.3 *denatured fuel ethanol, n*—fuel ethanol made unfit for beverage use by the addition of denaturants under formula(s) approved by the applicable regulatory agency to prevent the imposition of beverage alcohol tax. **D4806**

3.2.4 *ethanol, n*—ethyl alcohol, the chemical compound C_2H_5OH. **D4806**

3.2.5 *ethanol fuel blend, n*—a high concentration ethanol-based fuel for flexible-fuel spark-ignition engines and vehicles.

3.2.6 *flexible-fuel vehicle, n*—a vehicle designed to operate on either unleaded gasoline or ethanol fuel blends or mixtures of both. **D5798**

3.2.6.1 *Discussion*—In the United States, these vehicles have U.S. EPA emissions certifications using gasoline complying with U.S. EPA requirements and ethanol fuel blends that meet the requirements of Specification D5798.

3.2.7 *fuel blending dispenser, n*—a device for measuring and dispensing fuel, conforming to the standards established by the applicable regulatory jurisdictions, that can volumetrically combine two different base products into newly formed blended products that may be dispensed through a single hose or multiple hose dispenser configuration.

3.2.8 *fuel ethanol, n*—a grade of undenatured ethanol with other components common to its production (including water) that do not affect the use of the product as a component for automotive spark-ignition engine fuels. **D4806**

3.2.9 *gasoline, n*—a volatile mixture of liquid hydrocarbons, generally containing small amounts of additives, suitable for use as a fuel in spark-ignition, internal combustion engines. **D4814**

3.2.10 *gasoline-ethanol blend, n*—a fuel consisting primarily of gasoline along with a substantial amount (more than 0.35 mass % oxygen) of ethanol. **D4806**

3.2.11 *mid-level ethanol fuel blend, n*—an automotive spark-ignition engine fuel with an ethanol concentration greater than those suitable for conventional-fuel vehicles and less than the minimum ethanol content limit of Specification D5798.

3.2.11.1 *Discussion*—Mid-level ethanol fuel blends are often referred to as EXX, where XX represents the nominal percentage of denatured fuel ethanol.

4. Summary of Practice

4.1 This practice provides procedures for blending automotive spark-ignition engine fuels with ethanol concentrations greater than those suitable for conventional-fuel vehicles and less than the minimum ethanol content limit of Specification D5798. It addresses in detail the various factors which need to be considered when blending. These considerations include selection of fuel components for blending and general handling information.

5. General Requirements

5.1 The fuel blending components specified in this practice shall meet the performance requirements of Specifications D4814, and either D5798 or D4806 and all applicable regulatory fuel requirements.

5.2 The blending party, being responsible for the finished product, shall be provided, at the time of delivery of the fuel, on product transfer documents, an invoice, bill of lading, shipping paper, or other documentation, a declaration of the product type and grade of the fuels that are the intended fuel blending components. It is recommended that the blending party conduct testing and inspections to determine applicable properties that are necessary to ensure the blending of compliant mid-level ethanol fuel blends.

5.3 Product transfer documents alone may not be sufficient to demonstrate conformance. A Certificate of Analysis representative of the fuel being delivered is recommended to ensure compliance.

[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://dodssp.daps.dla.mil.

5.4 The fuel blender or testing analyst, or both, is warned that some requirements and test methods applicable to automotive spark-ignition engine fuels depend on whether the fuel is a gasoline, a gasoline-ethanol blend, or ethanol fuel blend. Once the amount of ethanol is known for the gasoline or gasoline-ethanol blend component and for the Specification D5798 ethanol fuel blend or Specification D4806 fuel ethanol component, the appropriate blending ratios can be determined for the blending of the two components.

5.4.1 Test Method D5501 shall be used for determination of the volume percent ethanol for the fuel ethanol component (that is, high concentration ethanol) and to verify the mid-level blend fuel, and Test Methods D4815 or D5599 shall be used for the gasoline or gasoline-ethanol blend component (that is, low concentration ethanol).

5.5 In order to ensure the presence of no more than 1 mg/kg inorganic chloride in the finished fuel or in Specification D5798, the ethanol component specified herein shall meet all the requirements of Specification D4806 with a more restrictive inorganic chloride limit as determined in Test Methods D7319 and D7328. The hydrocarbon blending component specified herein shall meet all the requirements of Specification D4814.

5.6 Mid-level ethanol fuel blends shall be visually free of water, sediment, and suspended matter. It shall be clear and bright at the point and condition of custody transfer and display no indication of phase separation.

5.7 The finished fuel shall also be free of any adulterant or contaminant that could render the fuel unacceptable for its commonly used applications.

6. Blending Procedures

6.1 This practice includes procedures for blending mid-level ethanol fuel blends at the bulk distribution terminal and at retail using a fuel blending dispenser.

6.2 A fuel blending plan shall be developed describing the necessary actions needed to achieve the targeted mid-level ethanol fuel blends and performance expectations of flexible-fuel vehicles.

6.2.1 Blending plans utilizing new equipment installation or conversion of existing equipment depend on thorough preparation and planning for the entire fuel system.

6.2.2 The investigation and design of the wetted fuel system starts with a review of the flow of the fuel from receipt through retail delivery ensuring materials compatibility with the blending components and the blended mid-level ethanol fuel blends.

6.2.3 Fuel storage and blending systems shall be approved by the jurisdictions in charge of storage tanks, fuel dispensers, and associated equipment.

6.2.4 If a single hose blending dispenser is used, the entire dispenser shall be dedicated to serving flexible-fuel vehicles. If a multiple hose dispenser configuration is used, one hose may be dedicated to E0 or E10 fuel, and one or more additional hoses may be dedicated to mid-level ethanol fuel blends.

6.2.5 Documentation of the findings and changes made during the system review may prove beneficial for the fuel blender's future reference.

6.2.6 The plan should include a strategy for handling the variability in ethanol and gasoline content in fuels being delivered and shall take into consideration the design and operational abilities of the blending meters that will be used.

6.2.7 This review should apply 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.

6.3 *Determination of Blending Component Properties:*

6.3.1 It is the responsibility of the suppliers of fuels that will be used for blending mid-level ethanol fuel blends to provide the blending parties with product transfer documents that contain, at a minimum, the information required by all applicable regulatory agencies. In the United States, this includes, among other items, a product description and the applicable Automotive Fuel Rating. The fuel supplier is responsible for ensuring that the product transfer documents are a true and accurate representation of the materials being supplied. Because product transfer documents are not always required to contain all information necessary for the blending party to accurately determine compliance with the final blend, the blending party must be prepared to either obtain a Certificate of Analysis from the fuel supplier(s), arrange for specific purchase specifications with their supplier(s), or have a sample of each component tested periodically to determine the ethanol content using Test Methods D4815 or D5599 for gasoline or gasoline-ethanol blends, and Test Method D5501 for Specification D5798 ethanol fuel blend, the resulting mid-level ethanol fuel blend, or for Specification D4806 denatured fuel ethanol. For Specification D4806 denatured fuel ethanol, the blending party shall also determine that the inorganic chloride content does not exceed a level that would result in finished mid-level ethanol fuel blend that would have more that the specified 1 mg⁄kg maximum of Specification D5798.

6.3.2 The blending party should be aware that the spark-ignition engine fuel (Specification D4814) used may contain ethanol up to the maximum concentrations permitted by fuel specifications and regulations, and that this content may change over time. Likewise, ethanol fuel blends (Specification D5798) may change in ethanol content depending upon the month and location of the intended sale of the ethanol fuel. These changes must be taken into account when preparing blending formulas for mid-level ethanol fuel blends.

6.3.3 The blending party shall also be aware that denatured fuel ethanol for fuel blending (Specification D4806) contains from 1.96 to 5.0 volume % hydrocarbons as denaturant (most often 2.0 to 2.5 volume % denaturant). This hydrocarbon content must also be taken into account when preparing blending formulas for mid-level ethanol fuel blends.

6.4 *Blending Formula:*

6.4.1 The formula used for blending mid-level ethanol fuel blends is based on the lever arm rule for binary components used to make a blend. To make such a blend, gasoline or gasoline-ethanol blend (Specification D4814) will be used to provide the hydrocarbon portion, and either ethanol fuel blend (Specification D5798) or denatured fuel ethanol (Specification D4806) will provide the ethanol portion. Blending calculations shall be based on "gross" gallons; (not temperature compensated net gallons).

6.4.2 The formula is:

$$FG = \frac{(FEE - FEML)}{(FEE - FEG)} \quad (1)$$

where:

FG = fraction of gasoline to be used to make the mid-level ethanol fuel blend,
(1 – FG) = fraction of the ethanol fuel or denatured fuel ethanol to be used to make the mid-level ethanol fuel blend,
FEE = fraction of ethanol in either the ethanol fuel blend (Specification D5798) or denatured fuel ethanol (Specification D4806),
FEML = the desired fraction of ethanol in the targeted mid-level ethanol fuel blend, and
FEG = the fraction of ethanol in the gasoline.

6.4.3 *Example 1, Bulk Distribution Terminal Blending*—The following example is used to make mid-level ethanol fuel blends at a terminal or bulk plant.

6.4.4 Assume that an E30 mid-level ethanol fuel blend is desired to be made from straight gasoline and denatured fuel ethanol at the terminal, thus *FEML* = 0.30.

6.4.5 The gasoline in terminal storage has no ethanol content, thus *FEG* in Eq 1 is 0.0.

6.4.6 The ethanol content in the denatured fuel ethanol at the terminal is determined to be 97.5 volume %, or *FEE* = 0.975.

6.4.7 For this example, we use Eq 1.

$$FG = \frac{(0.975 - 0.30)}{(0.975 - 0.0)} = 0.692$$

6.4.7.1 Thus the fraction of gasoline for this blend is 0.692 or 69.2 volume %. And the fraction of denatured fuel ethanol is 1 – 0.692 = 0.308 or 30.8 volume %.

6.4.8 *Example 2, Retail Station Blending*—The following example is used to make mid-level ethanol fuel blends at retail stations using fuel blending dispensers. Analysis of the ethanol content of the gasoline and the ethanol fuel blends is known from the supplier.

6.4.9 Assume that an E30 mid-level ethanol fuel blend is desired to be made from gasoline with 10 volume % denatured fuel ethanol (E10) and ethanol fuel blend at the retail site, thus *FEML* = 0.30.

6.4.10 The (E10) gasoline in the retail tank storage has 9.7 volume % ethanol content as reported by the fuel supplier, thus *FEG* in Eq 1 is 0.097.

6.4.11 The ethanol fuel blend at the site is reported by the supplier to contain 72.5 volume % ethanol, so the ethanol content in the denatured ethanol *FEE* = 0.725.

6.4.12 For this example, again we use Eq 1.

$$FG = \frac{(0.725 - 0.30)}{(0.725 - 0.097)} = 0.677$$

6.4.12.1 Thus the fraction of gasoline for this blend is 0.677 or 67.7 volume %. And the fraction of ethanol fuel is 1 – 0.677 = 0.323 or 32.3 volume %.

6.4.13 *Example 3, Retail Station Blending*—The following example is used to make mid-level ethanol fuel blends at retail stations using blending dispensers. In this case we have a bill of lading from the terminal listing the denatured fuel ethanol contents in the ethanol fuel blend and the gasoline.

6.4.14 Assume that an E50 mid-level ethanol fuel blend is desired to be made from gasoline with 10 volume % denatured fuel ethanol (E10) and ethanol fuel blend at the retail site, thus *FEML* = 0.50.

6.4.15 The E10 gasoline from the terminal has 9.5 volume % ethanol content assuming that the denatured fuel ethanol blend had 5.0 volume % denaturant (see 6.3.3); thus *FEG* = 0.095.

6.4.16 The ethanol fuel blend is reported from the supplier to be made from 70 volume % denatured fuel ethanol and 30 volume % gasoline. Since denatured fuel ethanol contains hydrocarbon denaturant, we must account for this hydrocarbon to get the true ethanol content in the ethanol fuel. The denatured fuel ethanol contains about 95% pure ethanol (see 6.3.3). Thus the ethanol content in the ethanol fuel is 0.095 (70 volume %) = 66.5 volume %, thus *FEE* = 0.665.

6.4.17 For this example, again we use Eq 1.

$$FG = \frac{(0.655 - 0.50)}{(0.665 - 0.095)} = 0.290$$

6.4.17.1 Thus the fraction of E10 gasoline for this blend is 0.290 or 29.0 volume % and the fraction of ethanol fuel blend is 1 – 0.290 = 0.710 or 71.0 volume %. If the ethanol and hydrocarbon components of the fuel inventory are unknown, retail fuel blending dispensers must be programmed to cease dispensing any mid-level ethanol fuel blend.

6.5 It is recommended that Mid-Level Ethanol fuel blends be identified as "Mid-Level Ethanol Blend." It is also recommended that the product description name be followed by the term EXX, where XX represents the nominal percentage of denatured fuel ethanol and that each fuel dispenser offering Mid-Level Ethanol Fuel Blends provide a cautionary statement advising the purchaser that the fuel is "For Flexible-Fuel Vehicles Only."

6.6 Target ethanol contents for the various mid-level ethanol fuel blends covered by this practice could follow a general practice of EXX ± 5 volume %.

6.7 *Volatility Requirements*—In order to confirm compliance with applicable volatility requirements, it is necessary for blending parties of mid-level ethanol blends to first confirm that the ethanol fuel blend used to prepare those blends is compliant with Specification D5798. This may be accomplished by receiving a certificate of analysis or other acceptable forms of product compliance assurance from the supplier of the ethanol fuel blends. If the blending party will be blending using Specification D4806 denatured fuel ethanol, the blending party shall arrange for the preparation of a representative sample of the target ethanol/hydrocarbon ratio using the Specification D4806 denatured fuel ethanol and Specification D4814 gasoline or gasoline-ethanol blend that will be used to make the blend and test the mixture for vapor pressure using Test Method D5191.

6.7.1 The measured vapor pressure shall meet the minimum vapor pressure specified in Specification D5798 for the volatility class for the time and location where the mid-level ethanol fuel blend will be used.

6.7.2 If the minimum vapor pressure limit is not met, a more volatile gasoline or gasoline-ethanol blend shall be used and the vapor pressure confirmed once again using the procedures of 6.7.

7. Keywords

7.1 automotive spark-ignition engine fuel; blending formula; conventional-fuel vehicles; denatured fuel ethanol; ethanol; ethanol fuel blend; flexible-fuel vehicles; fuel blending dispenser; fuel ethanol; inorganic chloride; mid-level ethanol fuel blends; phase separation; water tolerance

ANNEX

(Mandatory Information)

A1. HAZARDS INFORMATION

A1.1 General

A1.1.1 Denatured fuel ethanol meeting Specification D4806 has a low vapor pressure compared to ethanol fuel blend meeting Specification D5798. Because of this low vapor pressure, the vapor space in underground and other storage tanks is flammable under the temperatures usually encountered. Care must be taken to prevent ignition sources from igniting the vapor. This issue is more of a concern during cold weather and when the fuel tank has a low inventory. Storage tank systems used at retail sites to store ethanol blended fuels should meet all applicable regulatory codes of the jurisdictions in charge. The individual fuel marketers responsible for the blending systems should provide documentation of approval from each applicable regulatory agency.

A1.1.2 Delivery of Specification D4806 denatured fuel ethanol into the underground storage tank can cause a buildup of a static charge. Care must be taken when using a dipstick to gauge the tank contents immediately after completing a delivery. Sufficient time must be allowed for the static charge to dissipate before using a dipstick.

APPENDIX

(Nonmandatory Information)

X1. SIGNIFICANCE OF ASTM PRACTICE FOR BLENDING MID-LEVEL ETHANOL FUEL BLENDS

X1.1 Fuel Monitoring

X1.1.1 A plan for monitoring the quality of bulk fuel during prolonged storage is an integral part of a successful program. This includes a plan to replace aged fuel with fresh product at established intervals.

X1.1.2 Stored fuel should be periodically sampled and its quality assessed. Practices D4057 and D5842 provides guidance for sampling. Fuel contaminants and degradation products will usually settle to the bottom of a quiescent tank. “Bottom” or “clearance” samples, as defined in Practice D4057 should be included in the evaluation with an “All Level” sample. Retail samples may be collected using Practice D5842.

X1.2 Fuel Filtration

X1.2.1 During the distribution of spark-ignition engine fuels, it is possible for the fuel to become contaminated with potential filter blocking materials. While proper handling will minimize the contamination levels, it is recommended, and sometimes a regulatory requirement, that all fuel dispensers be equipped with filters of 10 µm or less nominal pore size at point of delivery to the customer.

X1.3 Samples, Containers, and Sample Handling

X1.3.1 *Introduction*—This section provides guidance on methods and techniques for the proper sampling of gasoline-ethanol blends. As fuel specifications become more stringent, and contaminants and impurities become more tightly controlled, even greater care needs to be taken in collecting and storing samples for quality assessment.

X1.3.2 *Sampling, Containers, and Sample Handling Recommendations:*

X1.3.2.1 Appropriate manual method sampling procedures found in Practice D4057 and Practice D5842, and automatic method sampling is covered in Practice D4177.

X1.3.2.2 The correct sample volume and appropriate container selection are important decisions that can impact test results. Refer to Practice D5854 for procedures on container selection and sample mixing and handling.

X1.3.2.3 For volatility determination of a sample, refer to Practice D5842 for special precautions recommended for representative sampling and handling instructions.

X1.3.2.4 Challenges may exist when collecting homogeneous sample from fuel dispensing systems at the retail level. Practice D5842 provides for an adequate sampling procedure

that results in a sample of fuel that is representative of the fuel being delivered into the vehicle fuel tank at the moment of sampling.

X1.4 Fuel Additives

X1.4.1 In the United States, U.S. EPA requires that gasoline and gasoline-ethanol blends be treated with the certified level of deposit control additive.

X1.4.2 Fuel additives for mid-level ethanol should be selected carefully as some additives may have limited or no solubility in denatured fuel ethanol.

X1.5 Water Tolerance

X1.5.1 The term *water tolerance* is used to indicate the ability of a gasoline-ethanol blend to dissolve water without phase separation. The most important factor, besides the quantity of water contracted, which governs the water tolerance of a fuel, is its temperature. As the temperature of the blend decreases, water tolerance decreases. Some other factors that affect water tolerance are alcohol concentration and aromatics content of the fuel. Water tolerance is improved as both alcohol and aromatics contents increase.

X1.6 Other

X1.6.1 *Microbial Contamination:*

X1.6.1.1 Uncontrolled microbial contamination in fuel systems may cause or contribute to a variety of problems including increased corrosivity, and decreased stability, filterability and caloric value. Microbial processes in fuel systems may also cause or contribute to system damage.

X1.6.1.2 Because the microbes contributing to the aforementioned problems may not be present in the fuel itself, no microbial quality criterion for fuels is recommended. However, it is important that personnel responsible for fuel quality understand how uncontrolled microbial contamination may affect fuel quality.

X1.6.1.3 Guide D6469 provides personnel with limited microbiological background an understanding of the symptoms, occurrences, and consequences of chronic microbial contamination. Guide D6469 also suggests means for detecting and controlling microbial contamination in fuels and fuel systems.

SUMMARY OF CHANGES

Subcommittee D02.A0 has identified the location of selected changes to this standard since the last issue (D7794 – 12) that may impact the use of this standard. (Approved Dec. 1, 2014.)

(1) Revised subsection 1.1.