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Revised Terms and Definitions for Gasoline and Diesel Fuel Standards

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On Dec. 9-12, 2019, Luis Erazo, analyst, attended the winter conference of the ASTM International in New Orleans, Louisiana. The summary below includes Stratas Advisors' observations at the meetings of Committee D02 on Petroleum Products, Liquid Fuels and Lubricants related to diesel fuel, gasoline, and aviation fuel.

Gasoline

ASTM D4814 Terminology

The D02.A0 gasoline committee continued their work to review the terminology and how potential updates to the wording would be applied in the ASTM D4814 Standard Specification for Automotive Spark-Ignition Engine Fuel. The discussion entailed potential updates to the definitions that the terminology task force proposed in an administrative ballot, which was deliberated at the [December 2018](#) winter conference in Atlanta, Georgia. Moreover, the discussion focused on the ballot which included the updated terminology associated with gasoline related terms intended to improve clarity.

Beginning with the scope of the ASTM D4814 standard, members of the D02.A0 gasoline committee discussed the insertion of "gasoline" in place of "fuels" in the initial portion of the scope when addressing the characteristics and operating conditions of automotive gasoline. The insertion of gasoline after automotive, was intended to add assurance throughout the standard that the gasoline being referenced dealt with spark-ignition engines and vehicles. In addition, discussion within the committee also centered on the possible addition of wording into the scope section dealing with the limits set in the specification, the timeframe for the maximum vapor pressure limits, and that the standard does not address aviation applications. Based on the work from the 2018 ballot, the terminology task force proposed adding the definitions into the terminology section of ASTM D4814 with slight modification.

The addition of a discussion point noting that liquefied natural gas (LNG) and liquefied propane gas (LPG) as a suitable fuel for use in spark-ignition internal combustion engines was also added to the terminology section. Furthermore, changes to the standard proposed removing the definitions for gasoline-alcohol blend, gasoline-ethanol blend, gasoline-ether blend, and gasoline-oxygenate blend. As for the remainder of the proposed changes to the standard, the terminology task force proposed to insert "automotive" in front of gasoline throughout the standard where applicable. The proposed changes also include adding "containing oxygenates", "containing alcohol", or "containing ethanol" wherever their use may be relevant. Despite the potential changes to the terminology within the standard, there were no technical changes that were proposed to ASTM D4814.

Although modifications to the standard were balloted prior to the 2019 winter conference, the proposed

changes received comments against the revisions to ASTM D4814. In order to answer those questions that committee members may have had regarding the proposed changes, several of those comments were discussed during the D02.A0 gasoline committee. Within the discussion, questions were raised as to the need for the insertion of the term automotive gasoline throughout the standard. Despite the term narrowing the focus for what type of gasoline it refers to, it was indicated that there was no clarification as to the need for the term even with the standard already having various definitions for various types of gasoline. As well as the need to justify the term automotive gasoline, there was additional discussion surrounding the use of the terms “basically” and “essentially” within the standard. It was noted that the use of the terms would lack any measurable way to quantify their meaning if placed in front of the term hydrocarbons. The discussion indicated that by using these terms, the user may not be able to discern the concentration level that would classify or equate it to “basically” or “essentially” hydrocarbon.

Also included in the discussion, members questioned the need to remove the terms gasoline-alcohol blend, gasoline-ethanol blend, gasoline-ether blend, and gasoline-oxygenate blend; in which these would be replaced by one single term, that being automotive gasoline. Lastly, the discussion also questioned the need to modify the terminology in standard without any particular technical rationale. Ultimately, by altering ASTM D4814 with the proposed changes, members indicated that there may be some confusion to new and existing users of the standard.

Diesel

Sulfur Content Definition

The D02.EO Diesel fuel committee discussed a ballot to match the definitions of “S (numerical specification maximum)” in ASTM D396 Standard Specification for Fuel Oils and ASTM D7467 Standard Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20). The current definitions in each of the standards are as follows:

- ASTM D396 - *S(numerical specification maximum)*, *n*—indicates the maximum sulfur content in $\mu\text{g/g}$ (ppm by mass) allowed by this specification in a fuel.
- ASTM D7467 - *S(numerical specification maximum)*—indicates the maximum sulfur content, in weight ppm ($\mu\text{g/g}$), allowed by this specification.

Since the introduction of ultra-low sulfur diesel fuel, the D02.EO diesel fuel committee observed there were questions as to what classifies as ultra-low sulfur. Depending on the region, this may mean 10 ppm by mass sulfur or it may mean 50 ppm by mass; yet in ASTM D975 Specification for Diesel Fuel, it means 15 ppm by mass. Based on the various classifications, the D02.EO committee determined that in order to identify the sulfur content in the diesel grade name was to include it in the grade name. Within the three standards, the S(15), S(500) and S(5000) were added to the particular grades indicated each standard. Although the S(XX) notation was added to the standards, the definitions of S (numerical specification maximum) were not identical. Taking into account the need to align the definition for S (numerical specification maximum), the committee discussed the proposal to redefine and synchronize the definition in ASTM D396, D975 and D7467.

The discussion regarding the proposal to standardize the definition considered removing the “weight ppm ($\mu\text{g/g}$)” notation from the definition and possibly adding “mg/kg” in its place. In addition, there was discussion regarding the possibility to add $\mu\text{g/g}$ (1×10^{-4} % by mass; mass factor 0.000001) as an equivalent to mg/kg. Although the modification is being considered, there were committee members who disagreed with the possible change to the proposed definition. Among the opposing views, it was reasoned that most users of the standard understand that the most common unit used in reference to sulfur in fuel is ppm or part per million. It was further noted that engine manufacturers and fuel producers are accustomed to using the ppm notation where applicable. By using the mg/kg or $\mu\text{g/g}$, it was indicated that this notation may cause some confusion for those not familiar with their use. Furthermore, it was also suggested that it may be necessary to add wording that would better represent the sulfur content designated for the particular diesel grade.

Lastly, it was indicated that the supporting test methods used to verify the parameters for each of the specifications may use mg/kg in the results generated, there may still be some uncertainty with the deletion of ppm considering it is a commonly used designation.

With the comments discussed during the committee meeting, it was concluded that the proposed changes to the definition for the three standards would take into account all of the information that was presented by committee members and will reissue the ballot with the revised wording in the first half of 2020.

Aviation Fuel

Unleaded Aviation Gasoline

The D02.J0 committee discussed the ballot regarding the development of a specification for a UL100 unleaded aviation gasoline to be used for testing purposes in aviation spark-ignition engines. Although the specification sets the parameters for an aviation gasoline, the discussion noted that select equipment or use of the fuel may allow for modifications to the range of characteristics in the specification. From the information presented related to the need for the ballot, those in the aviation and petroleum industries have been working together to move away from the use of leaded aviation gasoline and develop unleaded fuels to meet the requirements of the existing aircraft fleet. In addition, it was indicated that there is not a commercially available unleaded aviation gasoline approved for fleet-wide certification that satisfies the octane requirements of 100LL. Based on the development of the ballot, the need for the specification would help fulfill the “drop-in” fuel characteristic to meet or exceed 100LL performance properties with minimal or no modifications to infrastructure and aircraft operations.

The work for the development of the ballot dates back to December 2015; at that time a task force was formed to evaluate a potential unleaded replacement fuel for 100LL grade aviation gasoline. Moving forward, during the [June 2016](#) summer conference in Bellevue, Washington; a ballot was requested to initiate the process to create a test fuel specification for a 100 grade unleaded aviation gasoline. Since the request of the ballot, test data has been generated to illustrate the fuel properties of the UL100 aviation gasoline for review by D02.J0 committee members. Furthermore, testing was also conducted with the UL100 aviation gasoline to demonstrate that the fuel is fit for purpose.

During the discussion related to the ballot for the UL100 specification at the 2019 winter conference, it was disclosed that the status of the specification is currently being delayed due to comments received during the review process. From the comments received, it was concluded that the specification should not contain an ASTM designation for a fuel that is currently under development. This was meant to allow the test fuel to continue further review and evaluation of any new or questionable property or performance characteristics during the final development phase. Moreover, it was indicated that the review of the proposed specification by several committee members were critical of the standard due to issues that were related to the use of a certain additive package from a specific manufacturer; based on ASTM’s policies, they do not endorse a particular manufacturer for products that may be used in their standards. Although the process will continue during the coming year, the ballot may be reissued for review with the revisions and amendments based on comments submitted by committee members prior to the next summer conference in June 2020.