RFA RENEWABLE FUELS ASSOCIATION

July 27, 2015

Attention: Docket ID No. EPA-HQ-OAR-2015-0111

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

VIA EMAIL
a-and-r-docket@epa.gov

Re: Comments on *Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017*; Proposed Rule (80 Fed. Reg. 33,100; June 10, 2015).

Dear Administrator McCarthy,

The Renewable Fuels Association (RFA) is pleased to submit the attached comments in response to the U.S. Environmental Protection Agency's (EPA) proposed rule regarding 2014, 2015 and 2016 Standards for the Renewable Fuel Standard (RFS) Program (80 Fed. Reg. 33,100; June 10, 2015).

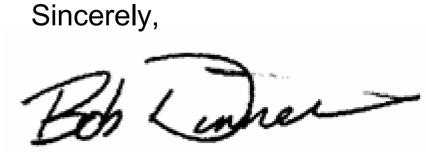
RFA is the leading trade association for America's ethanol industry. Its mission is to advance the development, production, and use of fuel ethanol by strengthening America's ethanol industry and raising awareness about the benefits of renewable fuels. Founded in 1981, RFA serves as the premier meeting ground for industry leaders and supporters. RFA's 300-plus members are working to help America become cleaner, safer, more energy secure, and economically vibrant.

Given the unmitigated success of the RFS program to date, EPA's proposal to substantially reduce 2014, 2015 and 2016 renewable volume obligations (RVO) from statutory levels is as surprising as it is imprudent. By adopting the narrative of the oil industry with regard to how much ethanol can be blended into gasoline, EPA has unnecessarily and illegally curtailed the unprecedented evolution occurring in the transportation fuels market that was delivering technology innovation, carbon reduction and consumer savings.

EPA purports to be intent on putting the RFS "back on track," and even suggests this proposal moves the RFS past the so-called "blend wall." It does not. By failing to consider carryover RINs in the assessment of available supply; by miscalculating RIN retirements from 2014 ethanol exports; by underestimating gasoline demand; and, most importantly, by deliberately misunderstanding the statute's general waiver authority and infusing consumption, infrastructure and demand considerations into a provision designed explicitly for lack of supply, the Agency has turned this important program on its head. In the process, EPA has rewarded oil companies for their steadfast refusal to allow renewable fuels access to the consumer – the very problem the RFS was designed to address!

For these reasons, and for those set forth more fully in the attached comments, RFA is strongly opposed to the proposal to reduce the 2014, 2015 and 2016 RVO for renewable fuel from the statutory levels specified by the statute. We encourage EPA to reconsider its proposal and finalize a rule that demonstrates fidelity to the statute and *truly* gets the RFS back on track, providing the consumer savings, carbon reductions, and energy benefits envisioned by Congress.

Sincerely,



Bob Dinneen
President & CEO

RENEWABLE FUELS ASSOCIATION

Comments of the Renewable Fuels Association (RFA) on the Proposed Rule for 2014-2016 Standards for the Renewable Fuel Standard Program

Docket ID: No. EPA-HQ-OAR-2015-0111

80 Fed. Reg. 33,100 (June 10, 2015).

Submitted July 27, 2015

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ATTACHMENTS

Attachment 1: Bruce A. Babcock and Sebastien Pouliot, Iowa State University Center for Agricultural and Rural Development, *Feasibility and Cost of Increasing US Ethanol Consumption Beyond E10*, CARD Policy Brief 14-PB 17 (Jan. 2014), available at https://www.card.iastate.edu/policy_briefs/display.aspx?id=1217.

Attachment 2: Bruce A. Babcock and Sebastien Pouliot, Iowa State University Center for Agricultural and Rural Development, *The Economic Role of RIN Prices*, CARD Policy Brief 13-PB 14 (Nov. 2013), available at https://www.card.iastate.edu/publications/dbs/pdffiles/13pb14.pdf.

Attachment 3: Kristy Moriarty and Janet Yanowitz. National Renewable Energy Laboratory and EcoEngineering, Inc. *E15 and Infrastructure*. Strategic Partnership Project Report NREL/TP-5400-64156 (May 2015), available at http://www.nrel.gov/docs/fy15osti/64156.pdf

Attachment 4: Informa Economics, Inc. *Analysis of Whether the Prices of Renewable Fuel Standard RINs Have Affected Retail Gasoline Prices*. (May 2015), available at http://ethanolrfa.3cdn.net/f1c5dfa9ac9743e9f8_csm6bcb8e.pdf

I. Executive Summary

The Renewable Fuels Association (RFA) submits these comments on EPA's proposed rule for 2014 renewable volume obligations (RVOs) under the Clean Air Act's (CAA) Renewable Fuel Standard (RFS). EPA, *Renewable Fuel Standard Program: Standards for 2014, 2015, and 2016 and Biomass-Based Diesel Volume for 2017*; Proposed Rule (80 Fed. Reg. 33,100; June 10, 2015).

EPA proposes to significantly reduce the volume of total renewable fuel under the 2014-2016 Renewable Volume Obligations (RVOs) from the statutory levels established by Congress in the 2007 Energy Independence and Security Act (EISA). The proposed reductions include cuts to the statutory requirements for cellulosic biofuel and advanced biofuel, as well as decreases to the requirements for undifferentiated renewable fuel (i.e., the portion of the RVO for which corn starch ethanol may qualify). In attempting to justify the proposed use of a "general waiver" to reduce the total applicable renewable fuel volumes, EPA cites "factors affecting the ability to distribute, blend, dispense, and consume…renewable fuels in vehicles."[1] The Agency refers to these "constraints" as an "important realit[y]."[2] But, even assuming that *distribution and consumption* are relevant standards for granting a waiver (they are not), EPA's "important reality" is pure fiction.

Had the Agency proposed keeping in place the statutory RVOs for renewable fuel, the RFS program's Renewable Identification Number (RIN) market mechanism would have been allowed to function exactly as intended to ensure that required volumes of renewable fuels were produced and consumed. But by proposing an RVO for renewable fuel that is below the 10 percent ethanol (E10) "blend wall," the proposed rule completely eviscerates the RIN market—the very mechanism that would enable compliance with statutory blending requirements. Indeed, by emasculating the RIN mechanism and attempting to codify the "blend wall" as a basis for modifying the 2014-2016 RVOs, EPA's proposal establishes a process for setting annual RFS requirements that virtually guarantees ethanol production and consumption will never expand beyond current levels.

The proposed rule's baffling approach to setting annual RVOs results in a circuitous, self-fulfilling prophecy that ultimately defeats the purpose of the RFS. Indeed, as stated by Babcock & Pouliot (2014) (Attachment 1), "If increased mandates [must] wait for the [E85 or E15] stations to be built, mandates will never increase."[3] Restoring the efficacy of the RIN mechanism by setting the RVOs for renewable fuel at statutory levels (i.e., points that are slightly above the E10 "blend wall") would break this vicious circle and ensure the goals of the RFS are met.

Relatedly, EPA's proposal badly misjudges the domestic supply of ethanol, as well as the physical capacity of existing vehicles and infrastructure to consume ethanol. The ethanol

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[1] 80 Fed. Reg. 33,111
[2] 80 Fed. Reg. 33,104
[3] Bruce A. Babcock and Sebastien Pouliot, Iowa State University Center for Agricultural and Rural Development, *Feasibility and Cost of Increasing US Ethanol Consumption Beyond E10,* at 3. CARD Policy Brief 14-PB 17 (Jan. 2014) (hereafter "Babcock & Pouliot (2014)"), available at https://www.card.iastate.edu/policy_briefs/display.aspx?id=1217.

industry has the capacity to supply substantially more renewable fuel than would be needed to meet the 2014-2016 RVOs. Indeed, 1.273 billion renewable fuel (D-code 6) RINs were generated in June 2015, demonstrating that the industry can supply at least 15.28 billion RINs to the market on an annualized basis.[4] Further, with a strong and consistent RIN signal in place, the vehicle fleet and refueling infrastructure can consume the statutorily required volumes of renewable fuel.

But even in a scenario where annual ethanol production falls short of statutory RVO levels, the availability of billions of carryover RINs will ensure the combined supply of RINs and physical gallons are sufficient to meet the statutory requirements. Astonishingly, EPA's proposal entirely omits the availability of carryover RINs to aid obligated parties in meeting RVO requirements.

EPA adds to these infirmities by clearly overstepping the boundaries of its statutory waiver authority; the Agency's proposed use of the "general waiver" provision in Clean Air Act §211(o)(7)(A) stands in clear violation of the law. Although EPA has the authority to use a general waiver to reduce the statutory renewable fuel volumes under certain narrow conditions specified in the statute, the Agency's interpretation of "inadequate domestic supply"—reading conceptions of "consumption" and "distribution" into that phrase—and its adoption of the so-called "blend wall" as a determinant of 2014 RVO levels are contrary to the text, purpose, structure and history of the RFS program. In attempting to justify its proposed use of the statute's general waiver authority to reduce renewable fuel volumes, EPA suggests the phrase "inadequate domestic supply" can be read to include "factors affecting the ability to distribute, blend, dispense, and consume…renewable fuels in vehicles." But, EPA's interpretation bends the meaning of "supply" well past its breaking point.

If finalized, EPA's proposal for 2014-2016 RFS requirements would simply perpetuate the status quo in our nation's energy market. By embracing the "blend wall" concept, the proposal effectively destroys the incentive to expand biofuel production and distribution capacity, and allows oil companies to blend only as much renewable fuel as they are comfortable using. The proposed rule would stifle innovation and fundamentally alter the future course of the RFS program.

For these reasons, and for those set forth more fully below, RFA is strongly opposed to the proposal to reduce the 2014-2016 RVOs for renewable fuel from the statutory levels. *We encourage EPA to reconsider its proposal and finalize 2014-2016 requirements for renewable fuel at the levels set by Congress*.

II. When Used Appropriately, the Cellulosic Waiver Provision Alone Can Enable Implementation of the 2014-2016 RVOs in a Way that is Consistent with Statutory Authorities, Congressional Intent, and "Marketplace Realities"

EPA proposes to reduce the statutorily required volumes of both advanced biofuel and total renewable fuel for 2014-2016 using a combination of the "cellulosic waiver" provision and the

[4] EPA, *RFS2 EMTS Informational Data* (viewed July 21, 2015) (hereafter "EPA EMTS data), available at http://www.epa.gov/otaq/fuels/rfsdata/index.htm .

“general waiver” provision.[5] While EPA’s proposed use of the cellulosic waiver provision is justified and consistent with statutory authorities, the proposed application of a general waiver is both irreconcilable with the statutory text (as discussed in Section VI of these comments) and unnecessary to facilitate compliance (as described in Section V of these comments). Appropriate use of the cellulosic waiver provision *alone* would result in RVOs that are “reasonably achievable,” obviating any need to use a general waiver to further reduce volume requirements.

a. EPA has the clear authority to reduce required cellulosic biofuel volumes if projected supplies of cellulosic biofuels are inadequate to meet statutory levels

Clean Air Act §211(o)(7)(D)(i) provides that if EPA determines the available volume of cellulosic biofuel will fall short of statutorily specified volumes, then “…the Administrator shall reduce the applicable volume of cellulosic biofuel required under [the statute] to the projected volume available during that calendar year.” Based on its assessment that the projected volume of cellulosic biofuels available in 2014-2016 will be less than the volumes specified in the statute, EPA is correctly proposing to invoke its authority to reduce the cellulosic biofuel volume requirements. On the subject of whether the specific levels of EPA’s proposed cellulosic RVOs are appropriate, we defer to the comments submitted by Abengoa Bioenergy, DuPont, Quad County Corn Processors, the Advanced Biofuels Business Council, and other leaders in the cellulosic biofuel space. Specifically on the subject of EPA’s management of the cellulosic biofuel waiver credit program, we support the comments submitted by Quad County Corn Processors.

b. EPA has the authority to waive the advanced biofuel standard and total renewable fuel standard by the “same or a lesser” volume as the cellulosic biofuel waiver

The waiver authority granted to the Administrator in CAA §211(o)(7)(D)(i) also allows EPA to reduce statutorily specified volumes of advanced biofuel and total renewable if the cellulosic biofuel volume has been reduced. Importantly, any reductions of the advanced biofuel and total renewable fuel volumes must be of an amount that is the same as, or lesser than, the amount of the cellulosic volume reduction. As shown in Table 1 below, EPA is proposing to reduce the 2014-2016 advanced biofuel standards by amounts that are lesser than the proposed cellulosic biofuel volume reductions, which clearly comports with the cellulosic waiver authority granted to the Agency. However, EPA is simultaneously proposing to reduce the total renewable fuel volumes for 2014-2016 by amounts that are *greater* than the proposed reductions in required cellulosic biofuel volumes. On its own, a proposal to waive total renewable fuel volumes by amounts larger than the proposed reductions in cellulosic biofuel volumes would be an obvious breach of EPA’s statutory waiver authority. Recognizing this, EPA has proposed to also apply a general waiver in combination with the cellulosic waiver; but, as discussed elsewhere in these

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[5] Throughout these comments, we refer to the waiver authority granted in CAA §211(o)(7)(D)(i) as the “cellulosic waiver.” We refer to the waiver authority granted in CAA §211(o)(7)(A) as the “general waiver.”

comments, the Agency's proposed use of the general waiver is impermissible and contrary to the statute.

Table 1. EPA Proposed Volumes for Advanced and Total Renewable Fuel in Relation to Proposed Cellulosic Biofuel Volume Reductions (billion ethanol-equivalent gallons)

	2014	2015	2016
Statutory Cellulosic Biofuel Volume Requirement	1.750	3.000	4.250
EPA Proposed Cellulosic Biofuel RVO	0.033	0.106	0.206
Amount of Proposed Cellulosic Biofuel Waiver	**1.717**	**2.894**	**4.044**
Statutory Advanced Biofuel Volume Requirement	3.750	5.500	7.250
EPA Proposed Advanced Biofuel RVO	2.680	2.900	3.400
Amount of Proposed Advanced Biofuel Waiver	**1.070**	**2.600**	**3.850**
Amount that Proposed Advanced Biofuel Waiver Exceeds (**+**) or Recedes (**-**) Proposed Cellulosic Waiver	**-0.647**	**-0.294**	**-0.194**
Statutory Total Renewable Fuel Volume Requirement	18.150	20.500	22.250
EPA Proposed Total Renewable Fuel RVO	15.930	16.300	17.400
Amount of Proposed Total Renewable Fuel Waiver	**2.220**	**4.200**	**4.850**
Amount that Proposed Total Renewable Fuel Waiver Exceeds (**+**) or Recedes (**-**) Proposed Cellulosic Waiver	**+0.503**	**+1.306**	**+0.806**

c. Appropriate use of the cellulosic biofuel waiver ***alone*** would result in RVO volumes that "can reasonably be expected to be produced and consumed" and are consistent with statutory authorities

As described above, EPA has proposed advanced biofuel volume reductions that are *less* than the proposed cellulosic biofuel volume reductions, but total renewable fuel volume reductions that are *greater* than the proposed cellulosic reduction. EPA's imbalanced application of the cellulosic biofuel reductions to the advanced and total renewable fuel categories has led the Agency to believe it must also use a general waiver to arrive at volumes that "can reasonably be expected to be produced and consumed."[6]

To the contrary, applying nothing more and nothing less than the full amount of the cellulosic biofuel waiver to both the advanced biofuel standard and the total renewable fuel standard would result in 2014-2016 RVOs that are "reasonably achievable" and consistent with statutory waiver authorities. Using only a cellulosic biofuel waiver—and fully carrying that waiver through both the advanced biofuel standard and the total renewable fuel standard—would obviate any need for invoking a general waiver and ensure EPA's implementation of the RFS remains faithful to the statutory text and Congressional intent of the program. Table 2 below shows how the cellulosic waiver can be fully carried through the advanced and total renewable fuel categories of the RFS.

[6] 80 Fed. Reg. 33,114

It should be noted that fully carrying through the cellulosic waiver to both the advanced biofuel standard and total renewable fuel volume *does not* prohibit or discourage growth in the production and use of advanced biofuels beyond required levels. Any advanced biofuel production in excess of the finalized advanced biofuel standards would be available to meet requirements for undifferentiated renewable fuel. That is, the undifferentiated renewable fuel category of the RFS is not in any way "reserved" for corn starch ethanol, and is in fact open to any and all qualifying renewable fuels. Indeed, rather than discouraging development in advanced biofuels, implementing the RFS in this manner would demonstrate to potential advanced biofuel developers, lenders and investors that EPA is managing the program in a way that is faithful to statutory waiver authorities and consistent with Congressional intent.

Table 2. Advanced and Total Renewable Fuel Standards with Full Carry-through of Cellulosic Waiver (billion ethanol-equivalent gallons)

	2014	**2015**	**2016**
Statutory Cellulosic Biofuel Volume Requirement	1.750	3.000	4.250
EPA Proposed Cellulosic Biofuel RVO	0.033	0.106	0.206
Amount of Proposed Cellulosic Biofuel Waiver	**1.717**	**2.894**	**4.044**
Statutory Advanced Biofuel Volume Requirement	3.750	5.500	7.250
Advanced Biofuel RVO with Full Cellulosic Waiver	2.033	2.606	3.206
Amount of Proposed Advanced Biofuel Waiver	**1.717**	**2.894**	**4.044**
Amount that Proposed Advanced Biofuel Waiver Exceeds (**+**) or Recedes (**-**) Proposed Cellulosic Waiver	**0.000**	**0.000**	**0.000**
Statutory Total Renewable Fuel Volume Requirement	18.150	20.500	22.250
Total Renewable Fuel RVO with Full Cellulosic Waiver	16.433	17.606	18.206
Amount of Proposed Total Renewable Fuel Waiver	**1.717**	**2.894**	**4.044**
Amount that Proposed Total Renewable Fuel Waiver Exceeds (**+**) or Recedes (**-**) Proposed Cellulosic Waiver	**0.000**	**0.000**	**0.000**

When actual and expected volumes of renewable fuel production in 2014-2016 are considered along with carryover RIN stocks and the likelihood of modest growth in E15 and E85 sales, the advanced and total renewable fuel volumes shown in Table 2 above are undoubtedly "reasonably achievable." Table 3 below shows one of many scenarios for complying with the volume requirements displayed in Table 2, which are based on fully carrying through the cellulosic biofuel waiver to both the advanced biofuel and total renewable fuel standards. Again, the ability to use surplus advanced biofuel (D5) and biomass-based diesel (D4) RINs for compliance with renewable fuel (D6) obligations adds significant flexibility and can help enable compliance under a variety of scenarios in which only the cellulosic waiver is exercised.

Table 3. Example of 2014-2016 Compliance Scenario Based on Full Carry-Through of the Cellulosic Biofuel Waiver (billion RINs)

	2014	2015	2016
BIOMASS-BASED DIESEL (D4)			
D4 RIN Carry-in Stocks[1]	0.384	0.500	0.175
D4 RIN Gross Generation[2]	2.710	2.475	2.900
D4 RIN Total Gross Supply	3.094	2.975	3.075
D4 RIN Retirements for Export/Non-compliance[2]	(0.195)	(0.140)	(0.125)
D4 RIN Net Total Available for Compliance	2.899	2.835	2.950
D4 RIN Obligation with Full Cellulosic Waiver Carry-Through	(2.000)	(2.500)	(2.800)
D4 RINs Used for D6 Compliance	(0.399)	(0.160)	0.000
D4 RIN Carry-out Stocks	0.500	0.175	0.150
ADVANCED BIOFUEL (D5)			
D5 RIN Carry-in Stocks[1]	0.056	0.090	0.074
D5 RIN Gross Generation[2]	0.143	0.079	0.250
D5 RIN Total Gross Supply	0.199	0.169	0.324
D5 RIN Retirements for Export/Non-compliance[2]	(0.009)	(0.005)	(0.010)
D5 RIN Net Total Available for Compliance	0.190	0.164	0.314
D5 RIN Obligation with Full Cellulosic Waiver Carry-Through	0.000	0.000	(0.200)
D5 RINs Used for D6 Compliance	(0.100)	(0.090)	(0.050)
D5 RIN Carry-out Stocks	0.090	0.074	0.064
CELLULOSIC BIOFUEL (D3)			
D3 RIN Carry-in Stocks	0.000	0.000	0.003
D3 RIN Gross Generation[2]	0.033	0.110	0.225
D3 RIN Total Gross Supply	0.033	0.110	0.228
D3 RIN Retirements for Export/Non-compliance	0.000	(0.001)	(0.002)
D3 RIN Net Total Available for Compliance	0.033	0.109	0.226
D3 RIN Obligation with Full Cellulosic Waiver Carry-Through	(0.033)	(0.106)	(0.206)
D3 RIN Carry-out Stocks	0.000	0.003	0.020
UNDIFFERENTIATED RENEWABLE FUEL (D6)			
D6 RIN Carry-in Stocks[1]	1.435	1.149	0.474
D6 RIN Gross Generation[2]	14.354	14.700	15.500
D6 RIN Total Gross Supply	15.789	15.849	15.974
D6 RIN Retirements for Export/Non-compliance[3]	(0.739)	(0.625)	(0.400)
D6 RIN Net Total Available for Compliance	15.050	15.224	15.574
D6 RIN Obligation with Full Cellulosic Waiver Carry-Through	14.400	15.000	15.000
D5 RINs Used for D6 Compliance	*(0.100)*	*(0.090)*	*(0.050)*
D4 RINs Used for D6 Compliance	*(0.399)*	*(0.160)*	*(0.000)*
D6 RINs Used for D6 Compliance	*(13.901)*	*(14.750)*	*(14.950)*
D6 RIN Carry-out Stocks	1.149	0.474	0.624
TOTAL (ALL D-CODES)			
Total Net RINs Available for Compliance	18.172	18.332	19.064
Total Renewable Fuel RVO w/Full Cell. Waiver Carry-Through	(16.433)	(17.606)	(18.206)
Total RIN Carry-out	1.739	0.726	0.858

[1] Paulson, N. "2015 1st Quarter RIN Update." *farmdoc daily* (5):78, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, April 29, 2015

[2] EMTS for 2014; RFA estimates for 2015 (based on YTD EMTS) and 2016

[3] See Section IV(a) of these comments for explanation of 2014. 2015-2016 are RFA estimates

As demonstrated above, use of some carryover RINs and appropriate application of the cellulosic waiver alone can facilitate compliance with the RFS in a way that is consistent with statutory waiver authorities. Therefore, EPA should exercise only its cellulosic waiver authority in finalizing the 2014-2016 RVOs. EPA's proposed use of the general waiver is not only unnecessary to enable compliance, but it also runs afoul of the statutory waiver authorities granted by Congress.

III. The Proposed Rule's Methodology for Establishing RVOs Inappropriately Ignores the Availability of Carryover RINs and Other Provisions Designed to Provide Compliance Flexibility for Obligated Parties

In its assessment of "reasonably achievable" RVO levels, EPA is inexplicably proposing to ignore the availability of carryover RIN credits. The Agency states it has "…decided that the availability of carryover RINs should not preclude reducing the applicable volumes…"[7] EPA's proposed exclusion of carryover RINs contradicts the Congressional intent behind the credit trading system, departs from the Agency's previous treatment of carryover RINs, and conflicts with past Court decisions supporting EPA's previous handling of carryover RINs. Because RINs represent physical gallons of renewable fuel that are, or were, part of the fuel supply, EPA's proposal to ignore carryover RINs essentially treats some gallons of previously produced renewable fuel as if they don't count, clearly undermining the intent of a program that was expressly designed to create a lasting growth market for renewable fuels.

a. The RIN credit program was designed to promote flexibility in complying with statutory RFS blending requirements

In establishing the RFS, Congress recognized the need to build flexibility into the program that would minimize the economic impacts of variations and anomalies in the marketplace, while still allowing obligated parties to comply with the program's annual requirements. Specifically, Congress created a credit trading system in CAA §211(o)(5) intended to add fungibility to the RFS program and allow compliance flexibility for obligated parties. Importantly, the program established by Congress allows trading, borrowing, and banking of the credits.

EPA was mindful of Congress' intended flexibility as it designed what would become the RFS program's RIN credit system: "One of our guiding principles in designing the RFS program was to *preserve the market mechanisms* that keep renewable fuel costs to a minimum."[8] In finalizing the original RFS regulations, EPA established that RIN credits would have a two-year lifespan and that a portion of an obligated party's current-year RVO could be satisfied with RIN credits generated in the previous compliance year.[9] Therefore, if renewable fuel production (and thus the availability of RINs) is reduced in a given compliance year because of an anomaly in the marketplace, obligated parties are still able to meet their obligations by turning in excess RINs

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[7] 80 Fed. Reg. 33,111

[8] EPA, *Regulation of Fuels and Fuel Additives: Renewable Fuel Standard Program – Summary and Analysis of Comments,* at 5-24 (Apr. 2007) EPA420-R-07-006 available at http://www.epa.gov/otaq/renewablefuels/420r07006.pdf (emphasis added).

[9] In practice, the life of some RINs can actually span 26 months because annual compliance reports for Year X are not due until February 28 of Year X+1.

generated in the previous compliance year. EPA established a 20-percent cap on the amount of the current-year RVO that can be satisfied with RINs generated in the previous compliance year.

Since the beginning of the RFS program, obligated parties have typically blended more ethanol than was annually required by the RFS due to ethanol's favorable blending economics. The single exception to this occurred in 2013, as the worst drought in 50 years reduced the 2012/13 corn supply and ethanol production fell below RFS requirements for renewable fuel. Still, between 2006 and 2012, U.S. ethanol production exceeded the RFS requirements for renewable fuel by a cumulative total of approximately 6.1 billion gallons. Accordingly, a large rolling "bank" of excess RIN credits was accumulated.

Because RINs have a two-year life, obligated parties generally retire their oldest RINs first when reconciling their RVOs at the end of a compliance year. The number of excess RIN credits currently available to obligated parties for compliance with 2014 RVOs has been estimated at 1.875 billion.[10] Importantly, biodiesel produced in excess of the biomass-based diesel standard and any other advanced biofuel produced in excess of the advanced biofuel standard may be used to generate D-code 6 RINs that can be used toward compliance with the "renewable fuel" RVO.

Thus, as demonstrated, obligated parties could comply with the 2014-2016 statutory requirements for renewable fuel by blending physical gallons of ethanol and biodiesel and retiring some carryover D6, D5, and D4 RINs. Importantly, as obligated parties begin to draw on RIN stocks to assist in compliance, RIN prices will respond, creating an economic incentive for biofuel producers, obligated parties, downstream marketers and blenders, and ultimately consumers to increase the production and consumption of renewable fuels. But now EPA proposes to circumvent the very "market mechanism" it proclaimed should be "preserved" in previous rulemakings.

b. EPA's proposal to ignore carryover RINs in setting 2014-2016 RVOs contradicts the Agency's treatment of carryover RINs in previous rulemaking and administrative actions

EPA's exclusion of carryover RINs is even more confounding given the Agency's treatment of surplus RINs in previous rulemakings and administrative actions. In the past, EPA has consistently accounted for the flexibility provided by carryover RINs when proposing annual RVO requirements and deciding waiver requests. Indeed, the 2010 final rule implementing the expanded RFS program concluded that "…it is ultimately the availability of qualifying fuel, as determined in part by *the number of RINs in the marketplace*, that will determine the extent to which EPA should issue a waiver of RFS requirements on the basis of inadequate domestic supply."[11] Moreover, in denying requests to waive the RFS in 2012, the Agency relied on an economic model that "…utilizes EPA estimates regarding excess, or 'rollover' RINs, that *will be*

[10] Paulson, N. "2015 1st Quarter RIN Update." *farmdoc daily* (5):78, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, April 29, 2015.
[11] EPA, *Regulation of Fuels and Fuel Additives: Changes to the Renewable Fuel Standard Program.* 75 Fed. Reg. 14,698 (emphasis added).

available for use for compliance purposes in the 2012/2013 corn marketing year time period."[12] The Notice further recognized that:

> [t]he *availability of rollover RINs*, the beneficial economics of producing ethanol gasoline blends, the generally low level of flexibility of refiners to shift from ethanol over a one year period, and the low price currently in the market for renewable fuel RINs all support the conclusion that waiving the RFS program would not be expected to have any effect on the production of ethanol.[13]

More recently, the final rule establishing 2013 RVOs explicitly included carryover RINs in its assessment of the obligated industry's ability to comply with statutory requirements.

> …[T]he combination of available volumes of advanced and non-advanced biofuel from both domestic and foreign sources, the ability of the transportation sector to consume some quantity of ethanol in blend levels higher than E10, *and carryover Renewable Identification numbers (RINs) from 2012* has led us to conclude that the statutory volumes for both advanced biofuel and total renewable fuel can be met in 2013. As a result, we are not reducing the national applicable volumes in the statute for either advanced biofuel or total renewable fuel volume...[14]

Further, in referencing *Monroe* v. *EPA* (D.C. Cir. 2014), EPA's proposed rule for 2014-2016 acknowledges that the "…availability of carryover RINs is a relevant consideration in determining the extent to which a waiver is justified…"[15] Indeed, the Court determined that EPA had reasonably declined to use the cellulosic waiver authority to reduce the 2013 advanced and total renewable fuel statutory volumes by examining "…the availability of renewable fuels that would qualify as advanced biofuel and renewable fuel, the ability of those fuels to be consumed, *and carryover RINs from 2012*."[16]

c. Obligated parties may carry a RIN deficit for one year at a time, providing additional flexibility in complying with statutory RFS requirements

Congress added even more compliance flexibility to the RFS program by including a provision to CAA §211(o)(5) allowing obligated parties to carry forward a renewable fuel deficit for one year. There is no limitation on the size of the deficit that may be carried forward; Congress required only that the deficit carried forward from the previous year must be completely offset in the current compliance year. Given the substantial amount of excess RIN credits available on the market today and the technical and economic feasibility of expanding ethanol consumption beyond the "blend wall," it is highly unlikely that obligated parties would need to carry a deficit

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[12] EPA, *Notice of Decision Regarding Requests for a Waiver of the Renewable Fuel Standard*, 77 Fed. Reg. 70,752, 70,757 (Nov. 27, 2012) (emphasis added).
[13] 77 Fed. Reg. at 70,775 (emphasis added).
[14] 78 Fed. Reg. at 49,794 (emphasis added).
[15] 80 Fed. Reg. 33,110 citing *Monroe* v. *EPA*, 750 F.3d 909, 915 (D.C. Cir. 2014)
[16] *Monroe* v. *EPA*, 750 F.3d 916. 915 (D.C. Cir. 2014) (emphasis added)

forward. Still, this provision creates an additional level of flexibility for obligated parties in the event compliance with the 2014-2016 standards becomes more challenging.

Given Congress's intent to provide compliance flexibility through the RFS credit trading system, and in light of both EPA's previous handling of carryover RINs and the Court's affirmation of EPA's previous treatment of carryover RINs, we believe the Agency *must* consider the impact of available RIN stocks when considering the final rule for 2014-2016 RVOs.

IV. EPA Has Failed to Justify the Need to Exercise Its General Waiver Authority for the 2014-2016 RVOs

EPA is proposing to reduce the applicable volumes of total renewable fuel in 2014-2016 using a combination of a cellulosic waiver and a general waiver. EPA suggests the use of a general waiver is necessary to address "practical and legal constraints on the supply of ethanol blends to the vehicles that can use them…"[17] As addressed elsewhere in these comments, EPA's proposed use of a general waiver to address perceived constraints on ethanol *consumption* clearly oversteps the bounds of the Agency's statutory authority and undermines Congressional intent. But beyond these legal maladies, the use of a general waiver to reduce the 2014-2016 RVOs for renewable fuel is completely unnecessary; the statutory volumes are "reasonably achievable" with judicious use of the cellulosic waiver provision, correction of an important error regarding 2014 RINs available, consideration of carryover RINs, and a proper understanding of the RIN market's ability to drive expanded renewable fuel production and use.

a. EPA's methodology for setting the 2014 standards contains critical errors that result in the significant underestimation of the number of RINs "expected to be available for compliance"

EPA states in the proposal that it intends to base the 2014 RVO requirement for renewable fuel on the "number of RINs supplied in 2014 that are *expected to be available for use* in complying with the standards."[18] EPA explains that the number of RINs expected to be available for compliance is determined by:

1) Starting with total RINs that were "generated for renewable fuel produced or imported in 2014 as recorded in the EPA-Moderated Transaction System (EMTS)";
2) Subtracting RINs "that have already been retired for non-compliance reasons";
3) Subtracting RINs that "would be expected to be retired to cover exports of renewable fuels."[19]

According to EPA, this three-step process results in a determination of the "net supply" of RINs that are "available for use" in complying with the 2014 standards. Table II.C.1-1 in the proposal

[17] 80 Fed. Reg. 33,104
[18] 80 Fed. Reg. 33,121 (emphasis added)
[19] *Id*.

presents EPA's calculations for arriving at "net supply."[20] The D6 RIN figures from Table II.C.1-1 are reproduced below in Table 4.

Table 4. Reproduction of TABLE II.C.1-1—2014 Actual Supply [Million RINs]

D code	Domestic production	Imports	Exports	Net supply
6………………………	13,759	336	846	13,250

Further details of this calculation are provided in a one-page document posted to the docket associated with this rulemaking ("docket worksheet").[21] The docket worksheet shows gross domestic D6 RIN generation of 14,008 million RINs and "corrections" of 249 million RINs. Presumably, the term "corrections" refers to RINs retired for a variety of non-compliance purposes that are thus unavailable for compliance.

Subtracting the 249 million RIN "corrections" from domestic generation of 14,008 million RINs results in a supply of 13,759 million RINs. This corresponds with the "domestic production" figure in Table II.C.1-1. EPA shows that 336 million D6 RINs were generated for imported renewable fuel, meaning the total RIN supply (net "corrections") is 14,095 million RINs. EPA then subtracts *total* 2014 ethanol exports of 846 million gallons, as reported by the Energy Information Administration (EIA), to derive its final "net supply" estimate of 13,250 million RINs. This represents EPA's idea of "the number of RINs supplied in 2014 that are *expected to be available for use* in complying with the standards." Thus, the 2014 RVO proposed for undifferentiated renewable fuel is 13.25 billion gallons.

There appear to be several important inconsistencies and errors associated with EPA's calculation of net supply of 2014 RINs "that are *expected to be available for use* in complying with the standards." These miscalculations, which are described in more detail below, result in the significant underestimation of 2014 RINs available for compliance.

i. EPA mistakenly assumes RINs will be retired for *every* gallon of ethanol exported in 2014, even though RINs were never generated for nearly half of 2014 ethanol exports.

EPA incorrectly subtracts the *total volume* of 2014 exports from gross RIN generation, when in fact RINs were *not generated*—and thus cannot be retired—for a minimum of 370 million gallons of exported ethanol (and a maximum of 393 million gallons). The RFS regulations require that ethanol *must* be denatured in order to generate a RIN and qualify as "renewable fuel."[22] Further, exporters of undenatured ethanol do not incur an exporter RVO because they are not exporting "renewable fuel" as defined by 40 CFR 80.1401.

According to the U.S. Census Bureau, 836 million gallons of ethanol for fuel use and industrial use were exported from the United States in 2014. Of this amount, 370.2 million gallons of fuel and industrial ethanol exports were classified as "undenatured," and thus did not ever generate a RIN. Moreover, 12.5 million gallons of denatured industrial ethanol were exported, and it is

[20] 80 Fed. Reg. 33,122
[21] Docket Id. No.: EPA-HQ-OAR-2015-0111-0004
[22] The definition for "renewable fuel" in 40 CFR 80.1401 specifies that "Ethanol covered by this definition shall be denatured as required and defined in 27 CFR parts 19 through 21."

unlikely that RINs were ever generated on this product (i.e., because it was not intended for use as transportation fuel, heating oil, or jet fuel). Denatured fuel ethanol exports totaled 452.99 million gallons in 2014 and it is safe to assume the RINs generated on this volume have been, or will be, retired and unavailable for compliance.

Notably, the export data reported by EIA (and relied upon by EPA) come from the same U.S. Census Bureau data set cited here. However, the EIA figures are presented as "lump sums" that also include beverage ethanol exports (explaining the 10 mg difference between EPA's figure of 846 mg and the 836 mg figure cited above).

Table 5. 2014 U.S. Ethanol Exports by Category, U.S. Census Bureau

Ethanol End Use (Harmonized Tariff Schedule Code)	Million Gallons	Generated a RIN?
Denatured Fuel Ethanol (2207200010)	452.99	Yes
Undenatured Fuel Ethanol (2207106010)	357.44	**No**
Denatured Ethanol, Industrial (non-fuel) (2207200090)	12.46	**Not Likely**
Undenatured Ethanol, Industrial (non-fuel) (2207106090)	12.75	**No**
Undenatured Ethanol, for Beverage Purposes (22071030000)[1]	~10.25	**No**
TOTAL	**845.89**	

[1] Exports of undenatured ethanol for beverage purposes are reported by U.S. Census Bureau in "proof gallons." We have converted "proof gallons" here to volumetric gallons.

Because only denatured fuel ethanol exports ever generated a RIN, EPA should only be subtracting denatured fuel ethanol exports from the gross RIN supply for its determination of net supply of RINs available for 2014 compliance.

ii. The data presented on EPA's EMTS web site for 2014 net RIN generation and retirement are inconsistent with the data presented in the proposal and in the EPA docket memo.

The EMTS web site shows total D6 RIN generation of 14,354 million RINs, compared to 14,345 million RINs shown in the docket worksheet.[23] Further, it is unclear what RIN retirements may be included in the category labeled as "corrections" in the docket worksheet. The docket worksheet shows 249 million RINs being unavailable due to "corrections," yet the EMTS web site shows just 14.2 million D6 RINs in the "RIN generation error corrections" category.

iii. EPA's proposal and docket memo appear to overlook RINs retired for other non-compliance purposes, which would not be available for compliance with 2014 standards.

The EMTS web site shows 273 million D6 RINs were retired for various non-compliance purposes other than error corrections.[24] It is unclear how EPA handled these unavailable RINs in the calculations for the proposed rule. The docket worksheet suggests EPA may have lumped

[23] EPA. RFS2 EMTS Informational Data. http://www.epa.gov/otaq/fuels/rfsdata/2014emts.htm, viewed 7/18/2015.

[24] *Id*. This figure excludes RINs retired to "Demonstrate Annual Compliance," as those RINs clearly were "available for compliance."

these other RIN retirements together with error corrections in the “corrections” category. But while total non-export retirements from the EMTS web site (287 million, including “RIN generation error corrections”) and “corrections” from the docket worksheet (249 million) are close, they do not match exactly.

iv. Proper accounting of RIN retirements for exported ethanol and non-compliance purposes leads to a significantly higher RVO for 2014.

When the errors identified here are corrected, EPA’s determination of 2014 RINs “available for compliance” with the 2014 standards should increase to approximately 13.614 billion RINs—nearly 3% above the proposed RVO of 13.25 billion gallons. Table 6 below compares the miscalculations from EPA’s proposal to the corrected calculations of the net supply of D6 RINs available for compliance with 2014 standards.

Table 6. Net D6 RINs Generated in 2014 Available for Compliance with 2014 RVO: Comparison of EPA Proposal Calculations to Corrected Calculations Based on U.S. Census Bureau Export Data and EPA EMTS RIN Retirement Data

	EPA Proposal[1]	Corrected[2]
Domestic D6 RIN Generation	14,008	14,017
Importer D6 RIN Generation	336	79
Foreign D6 RIN Generation	--	257
Total D6 RIN Generation (Gross)	**14,345**	**14,353**
D6 RINs Retired for Error Corrections	(249)	(14)
D6 RINs Retired for Renewable Fuel Used or Designated to be Used in Any Application that is Not Transportation Fuel, Heating Oil, or Jet Fuel	--	(254)
D6 RINs Retired for Remedial Action Pursuant to 80.1431c	--	(11)
D6 RINs Retired for Remediation of Invalid RIN Use for Compliance	--	(7)
D6 RINs Retired for Denatured Fuel Ethanol Exports	(846)	(453)
Total D6 RINs Unavailable for 2014 Compliance	**(1,095)**	**(739)**
Net D6 RINs Available for 2014 Compliance	**13,250**	**13,614**

[1] Based on 80 Fed. Reg. 33,122 (Table II.C.1-1) and EPA “docket memo”
[2] Based on EPA EMTS web site (http://www.epa.gov/otaq/fuels/rfsdata/2014emts.htm), viewed 7/18/2015, with exception of “D6 RINS Retired for Denatured Fuel Ethanol Exports” (U.S. Census)

b. The supply of renewable fuels and carryover RINs was adequate to meet the statutory RVO for renewable fuel in 2014

EPA may only use its general waiver authority to reduce statutory renewable fuel volumes in cases where the Administrator determines there is an “inadequate domestic supply” of renewable fuel to meet the statutory requirements. As discussed in Section VI of these comments, Congress intended that the term “supply” refer to the physical *quantity* of renewable fuel and RIN credits produced and available to obligated parties—and nothing more.

In 2014, ethanol producers manufactured 14.34 billion gallons of fuel ethanol.[25] Further, ethanol stocks at the end of 2014 were 787 million gallons, meaning the total physical supply of ethanol was 15.13 billion gallons in 2014.[26] This quantity was available to obligated parties to meet the statutory renewable fuel volume requirement of 14.4 billion gallons. But because EPA did not finalize and enforce an RVO for 2014 during the calendar year, obligated parties did not purchase all of the available ethanol, leaving ethanol producers with no choice but to export some of the renewable fuel they produced. Similarly, EMTS data show that 14.35 billion D6 RINs were generated in 2014, and as described in the previous section, at least 13.61 billion of those RINs remain available for compliance after RIN retirements for export and non-compliance are considered.[27]

Again, obligated parties may also turn in carryover RINs to comply with RVOs. Thus, RIN stocks must also be considered when determining whether the supply of renewable fuel is adequate to meet statutory requirements. The University of Illinois estimates that 1.435 billion D6 RINs were carried out of the 2013 compliance year and available for compliance with 2014 standards.[28] Therefore, when new D6 RINs generated in 2014 are combined with carryover RINs, the total supply of D6 RINs available for compliance with the 2014 RVO is at least 15.05 billion. This amount far exceeds the statutory RVO requirement of 14.4 billion gallons.

Finally, it is worth noting again that excess stocks of advanced (D5) and biomass-based diesel (D4) RINs may also be used to comply with undifferentiated renewable fuel (D6) obligations. To the extent that 2013 carryover stocks of D4 RINs are expected to be quite robust, some surplus D4 RINs could be used in lieu of D6 RINs to meet undifferentiated renewable obligations.

In summary, it is inarguable that the supply of renewable fuel and carryover RINs was adequate to meet the 2014 statutory renewable fuel volume requirement of 14.4 billion gallons. As such, EPA has no choice but to restore to the 2014 RVO to its statutory level.

c. Existing production capacity is capable of generating sufficient volumes of renewable fuel to meet statutory volume requirements in 2015 and 2016

The U.S. ethanol industry has the “nameplate” capacity to produce more than 15.4 billion gallons of renewable fuel.[29] And because most facilities can comfortably operate at 105% or more of their “nameplate” capacity, actual production capacity is likely closer to 16.2 billion gallons. Thus, existing capacity is more than suitable to produce an “adequate supply” of renewable fuel to meet the 15.0-billion-gallon statutory volumes for both 2015 and 2016. Moreover, the industry has already demonstrated its ability to produce more than15 billion gallons of ethanol on an annual basis. Ethanol production averaged 994,000 barrels per day

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[25] EIA. *U.S. Renewable Fuels Plant and Oxygenate Plant Net Production of Fuel Ethanol*. http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=m_epooxe_ynp_nus_mbbl&f=a
[26] EIA. *U.S. Ending Stocks of Fuel Ethanol*. http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mfestus1&f=a
[27] EPA. RFS2 EMTS Informational Data. http://www.epa.gov/otaq/fuels/rfsdata/2014emts.htm, viewed 7/18/2015.
[28] Paulson, N. "2015 1st Quarter RIN Update." *farmdoc daily* (5):78, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, April 29, 2015.
[29] RFA. *Biorefinery Locations*. http://www.ethanolrfa.org/bio-refinery-locations/

during the week of June 13-19, equivalent to 15.24 billion gallons annualized.[30] Similarly, D6 RIN production in June 2015 totaled 1.273 billion, for an annualized rate of 15.28 billion RINs.[31] Clearly, the industry has the capacity *and* the demonstrated capacity utilization rates to easily satisfy the statutory renewable fuel volume requirements in 2015 and 2016.

d. The proposal's analysis of "reasonably achievable" ethanol consumption in 2015 and 2016 is fundamentally flawed. EPA uses outdated gasoline demand projections, disregards the role of RINs in stimulating increased E15 and E85 consumption, and severely underestimates current and potential ethanol consumption capacity.

As detailed in later sections of these comments, Congress clearly did not intend for EPA to consider perceived constraints on "consumption" or "distribution" as a determinants in setting annual RVOs. However, to the extent the proposal relies on such unlawful factors, it grossly miscalculates the amount of ethanol consumption that is "reasonably achievable" in 2015 and 2016. We therefore offer the following remarks aimed at improving EPA's understanding of the marketplace's current and near-term capabilities.

i. EPA's calculation of the E10 "blend wall" relies on outdated EIA projections of 2015 and 2016 gasoline demand. In addition, recent EIA gasoline demand projections have repeatedly underestimated actual consumption

As outlined elsewhere in these comments, the purported E10 "blend wall" and perceived limitations on the ability to *consume* ethanol are not among the statutory criteria that may trigger a waiver of the total renewable fuel volumes required. Still, even if the E10 "blend wall" was a legitimate and allowable criterion for setting the annual RVO for renewable fuel, the proposal's estimates of the E10 saturation point in 2015 and 2016 are far too low. The accuracy of these projections is critically important, as they represent a key variable in the RVO calculations and also figure prominently into EPA's assessment of "reasonably achievable" levels of renewable fuel usage.

As the starting point for its determination of "reasonably achievable" ethanol consumption in 2015 and 2016, EPA's proposal calculates the maximum amount of ethanol that can be consumed in 10 percent ethanol blends (i.e., the E10 "blend wall"). Using EIA's May 2015 Short-Term Energy Outlook (STEO), EPA estimates "maximum ethanol consumption as E10" is 13.78 billion gallons in 2015 and 13.69 billion gallons in 2016.

However, EIA's gasoline demand projections for 2015 and 2016 have been revised upward in the most recent available (July 2015) STEO. In other words, the so-called "blend wall" continues to shift upward. We strongly encourage EPA to adopt the latest STEO gasoline demand figures, as well as some allowance for upward revision, for the final rule.

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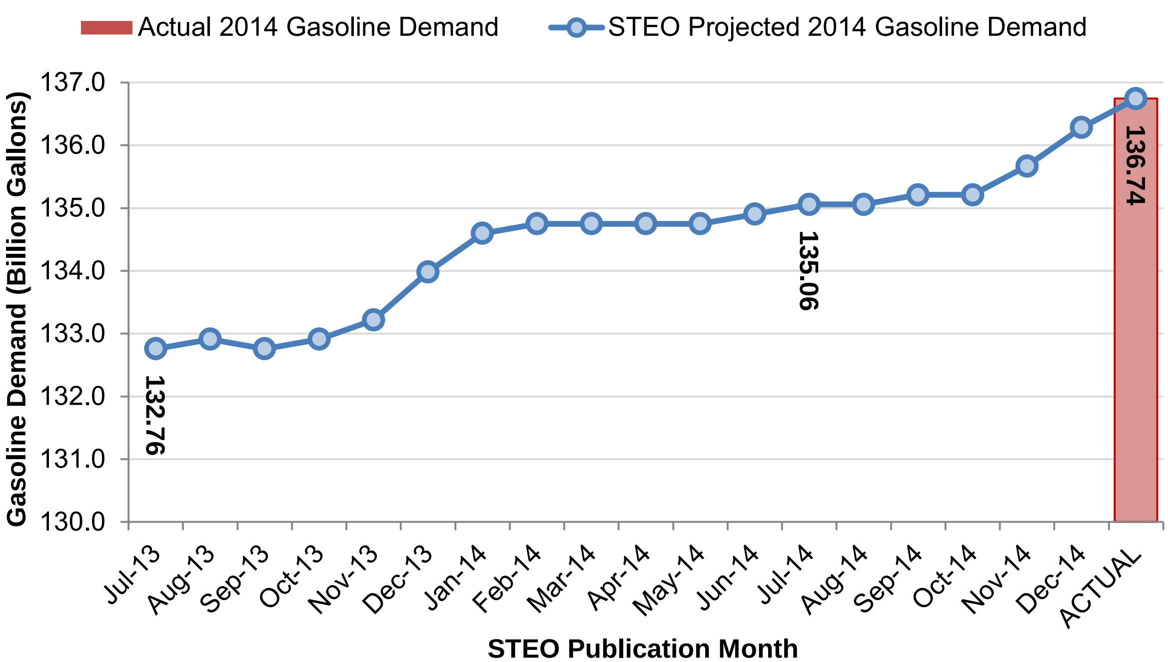
[30] EIA. *Weekly Ethanol Plant Production*. http://www.eia.gov/dnav/pet/pet_pnp_wprode_s1_w.htm
[31] EPA. RFS2 EMTS Informational Data. http://www.epa.gov/otaq/fuels/rfsdata/2014emts.htm, viewed 7/18/2015.

EPA should take into account the fact that recent EIA gasoline demand projections have exhibited a strong and consistent downward bias when later compared to *actual* demand data. The chart below, for example, shows that the Nov. 2013 STEO projected 2014 gasoline demand at 133.22 billion gallons. Subsequent STEOs steadily revised the 2014 gasoline demand projection upward, but even the December 2014 STEO projection proved to be well below actual 2014 gasoline demand. As shown in Figure 1, actual 2014 gasoline consumption was 1.2% higher than EIA's July 2014 STEO projection and 3.0% higher than the July 2013 STEO projection, meaning the July 2015 STEO projections (i.e., the most current projections) for 2015 and 2016 gasoline demand may prove similarly low.

Figure 1. 2014 U.S. Gasoline Demand: EIA STEO Projections vs. Actual



EIA has continued to regularly revise gasoline demand projections higher in recent STEOs as well, and we believe EPA's 2015 and 2016 RVO calculations should account for the demonstrated downward bias of EIA's gasoline projections. We believe EPA should adjust the estimate of 2015 and 2016 gasoline demand by the same percentage that actual 2014 gasoline demand exceeded the STEO projection in the corresponding 2014 and 2013 month of the most current STEO projection available at the time EPA prepares the final rule. For example, if the July 2015 STEO is the most recent projection available to EPA at the time the 2015 RVO is finalized, EPA should increase the EIA's 2015 gasoline demand projection by the same percentage that actual 2014 gasoline demand exceeded the July 2014 STEO projection (1.2%). Similarly, EPA should increase EIA's 2016 gasoline demand projection by the same percentage that actual 2014 gasoline demand exceeded the July 2013 STEO projection (3.0%). Table 7 below shows gasoline demand projections and the level of the "E10 blend wall" from EPA's proposal, as well as the most recent STEO. Gasoline demand and the "blend wall" with the upward revision allowance discussed here are also shown.

Table 7. Amount of Gasoline Projected to be Used in the 48 Contiguous States and Hawaii and "E10 Blend Wall": EPA Proposal vs. July 2015 STEO (billion gallons)

	U.S. Gasoline Consumption		"E10 Blend Wall"	
	2015	**2016**	**2015**	**2016**
EPA Proposal (based on May 2015 STEO)	138.37	137.58	13.78	13.69
EIA July 2015 STEO	139.09	138.78	13.90	13.87
EIA July 2015 STEO + Upward Revision Allowance	140.76	142.94	14.07	14.29

Note: All values exclude Alaska gasoline consumption (estimated at 0.26 billion gallons annually)

By underestimating 2015 and 2016 gasoline demand, EPA's starting point for "reasonably achievable" ethanol consumption is inappropriately low. Based on EIA's updated gasoline demand projections and an allowance for upward revision *alone*, EPA should raise its estimate of "reasonably achievable" ethanol consumption in E10 by 290 million gallons in 2015 and 600 million gallons in 2016—even under the Agency's legally mistaken belief that "supply" incorporates concepts of "consumption."

ii. By proposing an RVO for renewable fuel that is below the E10 "blend wall," the proposed rule eviscerates the very mechanism (i.e., the RIN market) that would enable compliance with statutory blending requirements.

In addition to providing compliance flexibility for obligated parties, the RIN system was expressly designed to stimulate investment in expanded renewable fuels production and distribution capacity. EPA's proposal acknowledges that the RIN mechanism works to "provide an incentive for renewable fuel producers to increase production," as well as to "…incentivize the development of the renewable fuel distribution infrastructure by helping to decrease the net cost of renewable fuels."[32] Yet, even with this understanding of the RIN market's ability to transform the marketplace, the Agency proceeds with a proposal that completely cripples the RIN and fails to motivate investment in expanded production and distribution capacity.

The fundamental workings of the RIN device are quite simple. As renewable fuel blending requirements approach or exceed perceived market barriers such as the E10 "blend wall," demand for detached RINs for compliance will increase and, naturally, prices will rise. When RIN prices are lower than the equivalent cost of installing infrastructure to dispense ethanol blends above E10, obligated parties will purchase RINs on the open market to cover blending obligations above the "blend wall." But as demand for RINs increases and prices rise, rational obligated parties will, at some price point, find it more economical to invest in the infrastructure necessary to distribute high-level ethanol blends than it is to purchase RINs on the open market.

[32] 80 Fed. Reg. 33,119

As explained by Babcock & Pouliot (2013) (Attachment 2), "The cure for high compliance costs is investment in E85 and E15 infrastructures, which, in turn, would allow for the higher future biofuel consumption levels that are envisioned in current policy."[33]

Installing the infrastructure to dispense greater volumes of E85 and E15 decreases pressure on the RIN market, results in lower RIN prices and, in turn, lowers compliance costs for obligated parties. Babcock & Pouliot (2014) show that every $1 of investment in E85 infrastructure would have reduced compliance costs for obligated parties by $108 in 2014 if the statutory RVO of 14.4 billion gallons had been maintained and enforced. In other words, rational economic actors considering the financial tradeoffs associated with meeting RFS obligations would favor installation of infrastructure over purchasing detached RINs. Assuming no new E85 or E15 retail infrastructure is installed in the near term, setting the 2014 RVO for renewable fuel at the statutory level of 14.4 billion gallons would have resulted in average RIN prices of $0.69, according to Babcock & Pouliot (2014). But if only 500 additional E85 stations had been added (roughly a 15 percent increase over existing E85 stations at the beginning of 2014), average RIN prices fall to just $0.18. According to the report, "[t]his drop in RIN price represents more than a $7 billion drop in the total value of RINs than would be used for compliance in 2014."[34] Meanwhile, "[t]he cost of adding the additional stations would be $65 million."[35] This example clearly demonstrates how RINs effectively function to incentivize the investments that would facilitate expanded ethanol consumption and compliance with statutory RFS requirements.

At the same time, higher RIN prices enable retail discounting of E15, E85, and mid-level blends ("MLBs")[36] by lowering the effective cost of ethanol in the blend. That is, a marketer who purchases ethanol (with RINs attached) and blends it with gasoline to make E15, E85 or MLBs can separate the RINs from the ethanol gallons and sell them to obligated parties who need additional RINs for compliance. As such, the sale of RINs allows marketers and retailers to reduce the price of E15, E85 and MLBs for consumers, thus stimulating increased consumption. EPA recognizes this occurrence, stating "the higher the price received for the RIN, the lower the effective cost of the renewable fuel."[37]

Unfortunately, EPA's proposal has greatly diminished the economic incentive to invest in the infrastructure necessary to dispense higher-level ethanol blends and has impaired the ability of retailers to offer E85 and E15 at meaningful discounts to E10. By adopting the oil industry's "blend wall" concept, EPA's proposal—if finalized—would allow obligated parties to comply simply by blending E10 in both 2015 and 2016. Thus, the proposal destabilizes the RIN

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[33] Bruce A. Babcock and Sebastien Pouliot, Iowa State University Center for Agricultural and Rural Development, *The Economic Role of RIN Prices,* at 4. CARD Policy Brief 13-PB 14 (Nov. 2013) (hereafter "Babcock & Pouliot (2013)"), available at https://www.card.iastate.edu/publications/dbs/pdffiles/13pb14.pdf.

[34] Babcock & Pouliot (2014), at 2.

[35] *Id.*

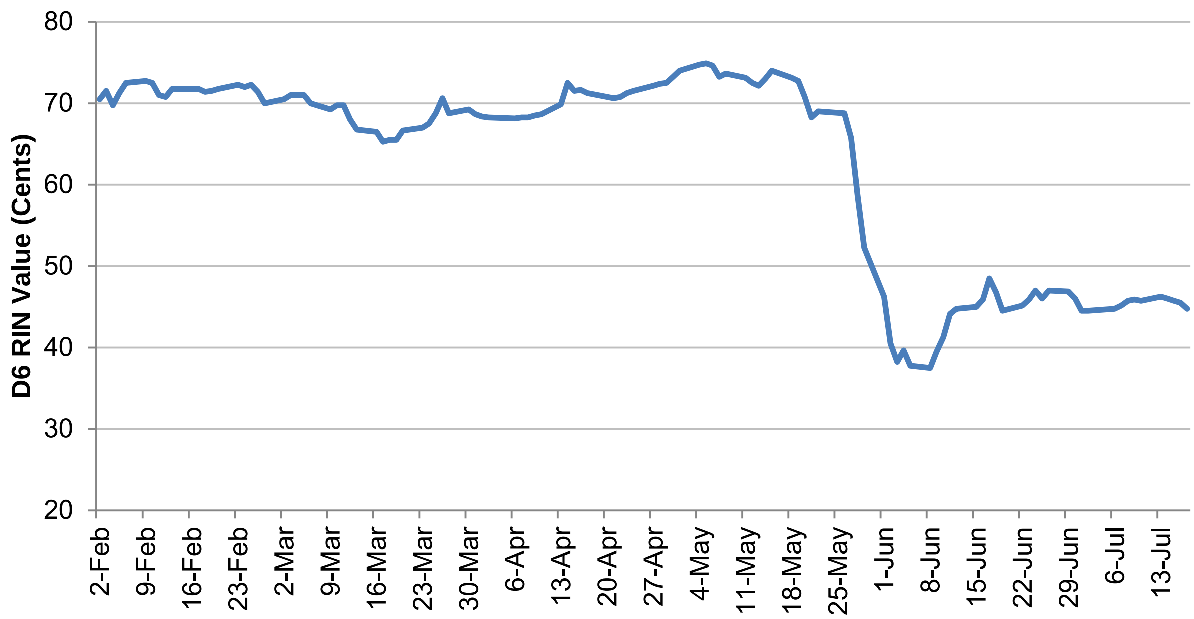
[36] Mid-level blends, or MLBs, are alternative fuel gasoline/ethanol blends containing 16-50% ethanol by volume.

[37] 80 Fed. Reg. 33,119

mechanism and eliminates the means of driving investment in expanded renewable fuel production and distribution infrastructure. In essence, EPA's proposal seeks to make the alternative method of complying with RFS requirements (i.e., purchasing and turning in banked RINs) less costly for obligated parties than the intended primary method of compliance (i.e., purchasing and blending *physical volumes* of renewable fuels). This is plainly a backward approach to implementing the RFS.

Indeed, evidence of the fact that EPA's proposal requires no change in behavior by obligated parties is found in recent RIN market trends. RIN prices fell dramatically upon the realization that EPA was proposing 2014-2016 RVO levels that are below the E10 "blend wall." According to data from the Oil Price Information Service (OPIS), prices for 2015 D6 RINs averaged 71 cents in May 2015, but had plunged by nearly half to just 37.5 cents by June 8, 2015—a week after the release of EPA's proposal (Figure 2). D6 RIN values have slightly recovered in recent weeks, but remain far below pre-proposal levels.

Figure 2. Daily 2015 D6 RIN Closing Price (OPIS)



Setting the 2014-2016 RVOs for renewable fuel at the statutory levels would restore the efficacy of the RIN market mechanism and drive the investments necessary to facilitate compliance in 2015, 2016 and beyond.

iii. The proposed rule largely ignores the demonstrated ability of RINs to induce expanded consumption of E15 and E85 and stimulate investment in refueling infrastructure.

As described above, EPA's proposal—which sets the RVOs for renewable fuel below the E10 "blend wall"—has undermined the RIN mechanism and halted the transformation of the liquid fuels marketplace just as it was beginning in earnest. The experience of 2013 and certain periods in 2014 clearly demonstrate that RINs will function exactly as intended to drive investment in E85 and E15 infrastructure, facilitate discounted pricing at the pump, and allow obligated parties to meet statutory RFS requirements.

1. The experience of 2013 proves that RINs provide a strong economic incentive to expand E85 production and consumption.

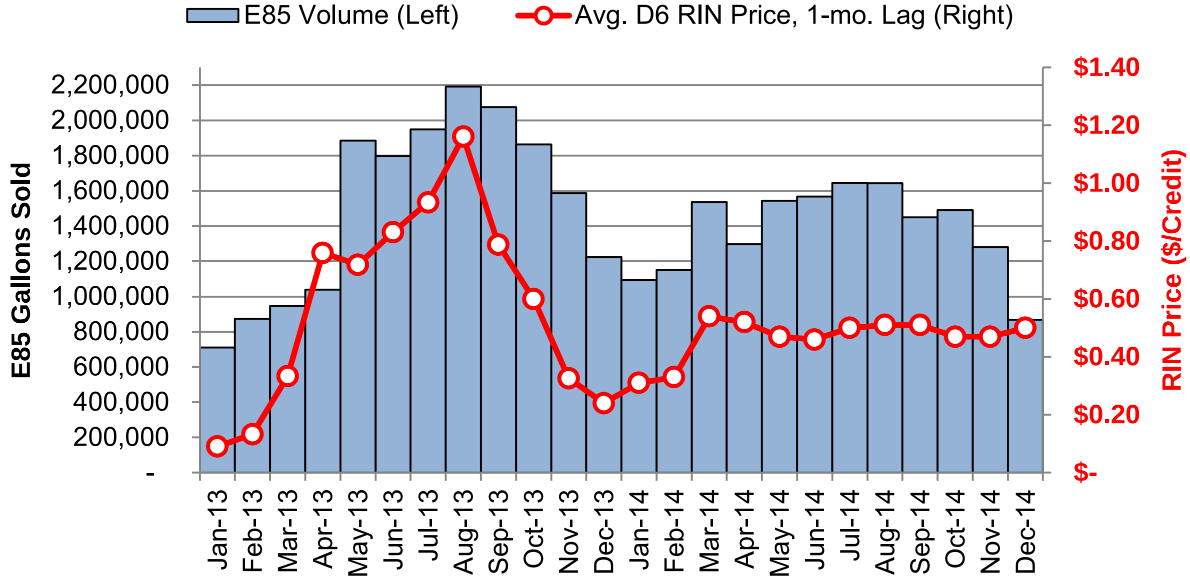
Higher RIN prices in the spring and summer of 2013 led to dramatic growth in E85 consumption. Progressive fuel blenders and marketers purchased ethanol (with RINs attached), blended it to make E85, separated the RINs from the gallons, and sold them to refiners who had chosen to buy RINs rather than physical gallons of ethanol to comply with RFS. Thus, the sale of RINs allowed enterprising retailers and marketers to reduce the price of E85 for consumers. At many E85 stations during the summer, E85 was offered at a price at or below its energy equivalent value to E10, meaning the consumer's cost per mile on E85 was the same or less than the cost per mile on E10. EIA chronicled the RIN-driven changes in E85 prices, finding that "…recent declines in E85 prices at stations offering that fuel in several Midwestern states have brought E85 close to price parity with regular gasoline on an energy content basis."[38]

As expected, consumers responded to lower E85 prices in 2013 by increasing consumption. While there are no reliable data tracking national E85 sales volumes, at least two state agencies track E85 consumption in their states. Data from both agencies indicate dramatic growth in E85 sales in 2013, as the discount between E85 and E10 widened and FFV owners responded to lower E85 prices. The data also clearly indicate that E85 sales volumes were well correlated to the movements in RIN prices. That is, as RIN prices increased, there was a concomitant increase in E85 sales. Minnesota Department of Commerce data show that E85 sales in the state nearly tripled between January and August 2013 as RIN prices increased from an average of $0.13 to an average of $0.79 (Figure 3).[39] Predictably, E85 sales volumes fell in October and November 2013 as RIN prices declined from their summer highs following the leak of EPA's original 2014 RVO proposed rule.

[38] EIA, *Today in Energy: E85 motor fuel is increasingly price-competitive with gasoline in parts of the Midwest* (Sept. 19, 2013), available at http://www.eia.gov/todayinenergy/detail.cfm?id=13031 .

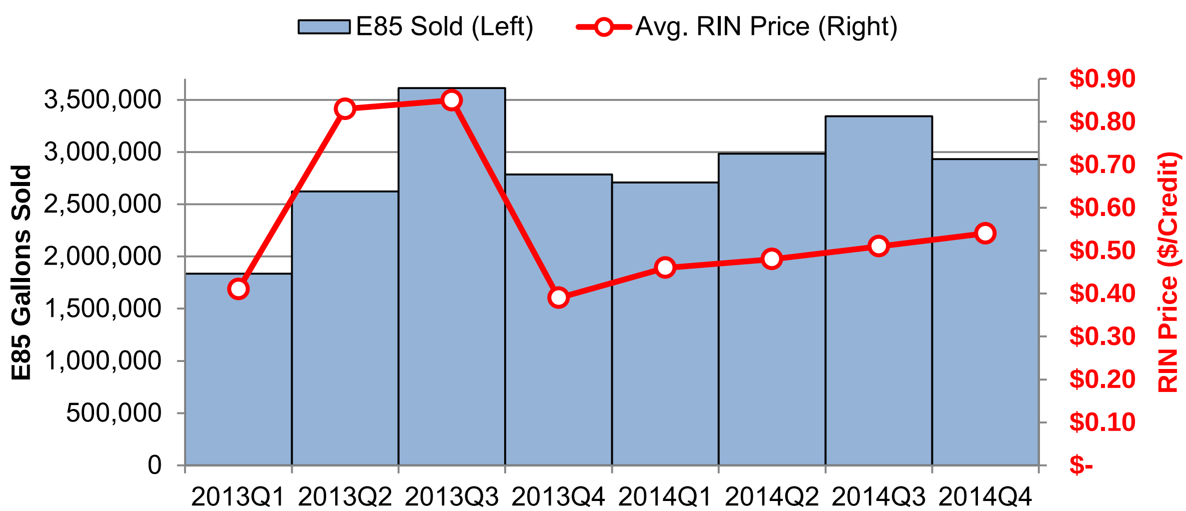
[39] Minnesota Dept. of Commerce, *2013 Minnesota E85 + Mid-Blends Station Report* (viewed January 8, 2014) (hereafter "MNDOC E85 Station Report"), available at http://mn.gov/commerce/energy/images/E-85-Fuel-Use-Data.pdf .

Figure 3. MONTHLY MINNESOTA E85 SALES vs. RIN PRICE



Similarly, data from the Iowa Department of Revenue show E85 sales in the state doubled from the first quarter of 2013 to the third quarter of that year, as quarterly average RIN prices also doubled (Figure 4).[40] As RIN prices plunged in the fourth quarter of 2013, E85 consumption also fell off considerably. Gradual recovery of RIN prices in the first three quarters of 2014 was accompanied by gradual increases in E85 consumption.

Figure 4. QUARTERLY IOWA E85 SALES vs. AVERAGE RIN PRICE



[40] Iowa Dept. of Revenue, *Motor Fuel Tax Forms and Information: E85 Quarterly Report—Gallons Sold* (viewed January 18, 2014), available at http://www.iowa.gov/tax/forms/motor.html .

The E85 growth trends indicated by the Minnesota and Iowa data certainly would have continued—or accelerated—had RIN prices remained at stable, elevated levels. Logically, if the E85 pricing experienced during the summer of 2013 had been sustained, an increasing number of FFV drivers would have become aware of the attractive pricing and E85 demand would have increased further. As observed and documented by Pouliot (2015), larger retail discounts for E85 translate directly into an increased willingness by FFV owners to purchase E85.[41]

EPA appears to recognize that RINs provide a strong economic incentive to reduce pump prices for E85 relative to E10. According to the proposal, "…the RFS program, operating through the RIN system should increase the consumption of renewable fuels by ultimately decreasing the cost of renewable fuel blends to consumers relative to the cost of fuel blends that do not contain renewable fuels."[42] Given this recognition, it is perplexing that EPA failed in its projection of 2015 and 2016 E85 consumption to account for the demonstrated ability of RINs to drive favorable E85 pricing and expanded usage under various RVO scenarios.

2. *Investment in E15 also grew rapidly in 2013 and 2014 in response to elevated RIN prices.*

Increased RIN values and the assumption that EPA might finalize 2015-2016 RVOs above the "blend wall" have also driven greater investment in E15. The first gallons of E15 were sold at a retail gas station in Lawrence, Kansas, in July 2012, and at the beginning of 2013 approximately 10 retail gas stations were offering E15.[43] Today, an estimated 110 stations are selling E15 and many others have announced plans to begin offering the blend in the near future.

Nearly three years after the first sale of E15 to the public, nearly 10 million gallons of E15 have been sold from retail stations in 16 states and consumed in vehicles built in 2001 or later. It is estimated that some 200 million miles have been driven on E15 since its introduction. While the volume of E15 sold to date is relatively small, there is tremendous potential to rapidly expand E15 consumption given the low cost of infrastructure upgrades and the large percentage of the existing automotive fleet that may legally use E15.

Further, the E15 experience to date has demonstrated quite clearly that the fuel is safe, effective and economical. Users of E15 over the past three years *have not* experienced the deleterious engine effects suggested by the oil industry. In fact, there has not been a single reported and confirmed case of engine damage or inferior performance due to E15. Similarly, there have been no reported and confirmed cases of E15 misfueling in non-approved equipment.

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[41] S. Pouliot. Iowa State University. *Willingness to pay for E85: evidence from revealed and stated preferences*. Presentation to Berkeley Bioeconomy Conference. April 1, 2015

[42] 80 Fed. Reg. 33,119

[43] RFA*, First Station in the Nation Offers E15 in Kansas* (July 11, 2012), available at http://www.ethanolrfa.org/news/entry/first-station-in-the-nation-offers-e15-in-kansas/ .

In recent months, major retail chains have announced plans to offer E15 (and, in most cases, E85) at dozens of retail gas stations. Murphy USA, which operates nearly 1,200 retail stores in 23 states) was the first major retail chain to announce that it would begin selling E15 in late 2013.[44] Similarly, MAPCO Express, Inc. announced on January 15, 2014, that it will offer E15 at every gasoline pump at approximately 100 of its retail gasoline stations.[45] In announcing the initiative, MAPCO Vice President of Business Development Dan Gordon stated, "Ethanol based fuels have been a lower per-gallon cost alternative over the past few years and this should allow us to offer our customers additional fuel options."[46] These announcements were followed by similar statements from major retailers Cenex, Petro Serve USA, Kum & Go, Sheetz, and Protec Fuels. Taken together, these retailers will be offering E15 (and, in most cases, E85 as well) from some 300 new stations by late 2016 or early 2017. These investments were undoubtedly facilitated by the expectation that EPA would enforce RFS levels that necessitate moving beyond the so-called "blend wall."

If other major retailers follow the lead of these first-movers (which may be necessary to remain competitive in the markets where these chains operate), retail access to E15 could expand rapidly, and total ethanol consumption could grow dramatically. The low cost of converting to E15 and the prospect of a quick return on investment is likely to attract some retailers who may be reluctant to make considerably larger investments in E85 infrastructure. A recent letter to the U.S. Department of Agriculture from the Petroleum Equipment Institute shows that some stations (i.e., those with existing compatible equipment) may need to invest no more than $1,000 to begin selling E15.[47] Further, a new report by the National Renewable Energy Laboratory (Attachment 3) confirms that the overwhelming majority of existing underground storage tanks are compatible with E15 and other higher-level ethanol blends.[48]

Given these recent developments in the E15 marketplace, it is surprising that EPA entirely neglected the potential use of E15 in 2015 and especially 2016 as a pathway to compliance with statutory blending requirements. We encourage EPA to reconsider its decision to exclude any potential contribution from E15 in its estimate of potential ethanol consumption in 2015 and 2016.

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[44] Convenience Store News, *Murphy USA Opens Arkansas' First E15 Station* (Dec. 12, 2013), available at http://www.csnews.com/top-story-fuels-c64-murphy_usa_opens_arkansas__first_e15_station-64954.html .

[45] Business Wire (MAPCO Press Release), *MAPCO to offer E15 to customers in 2014* (Jan. 15, 2014), available at http://www.businesswire.com/news/home/20140115005879/en/MAPCO-offer-E15-Customers-2014 .

[46] *Id*.

[47] Erin Voegle, Ethanol Producer Magazine, *PEI research estimates E15 conversion costs for retail stations* (Sept. 11, 2013), available at http://www.ethanolproducer.com/articles/10224/pei-research-estimates-e15-conversion-costs-for-retail-stations .

[48] K. Moriarty & J. Yanowitz. May 2015. *E15 and Infrastructure*. Available at: http://www.nrel.gov/docs/fy15osti/64156.pdf

iv. Existing vehicles, refueling infrastructure and carryover RINs are sufficient to facilitate compliance with the statutory renewable fuel requirements in 2014-2016

EPA's proposal appears to adopt the oil industry's contention that the emergence of the E10 "blend wall" prevents obligated parties from fulfilling their statutory blending requirements under the RFS in 2014 and beyond. EPA apparently agrees with the oil industry that current infrastructure cannot deliver, and the current automotive fleet cannot consume, the volume of renewable fuels necessary to meet the RFS in 2014 and subsequent years. Indeed, EPA cites supposed "…practical constraints on the amount of ethanol that can be supplied to the *vehicles that can use it…*"[49] as a major factor in its decision to attempt invoking the general waiver to lower the statutory RVOs.

Even if these were statutorily relevant factors in setting the RVOs for 2014-2016, the underlying factual assumptions are incorrect. Setting the renewable fuel blending requirements at statutory levels would result in a strong and consistent RIN signal, which would drive investment in infrastructure and stimulate increased E15 and E85 consumption.

v. The existing vehicle fleet has the capacity to consume roughly 29 billion gallons of ethanol—nearly *twice* the amount of the undifferentiated renewable fuel required by the statute in 2014, 2015 and 2016

Light-duty vehicle compatibility with ethanol blends above E10 is not a significant limiting factor in expanding ethanol consumption beyond the "blend wall."

According to the Department of Energy, 17.4 FFVs capable of operating on blends up to E85 were "on U.S. roads" as of December 2014.[50] Assuming 2015 FFV production and sales levels are consistent with 20123-2014 rates, approximately 19.5 million FFVs will be on the road by the end of 2015. Accordingly, the current fleet of FFVs *alone* is capable of consuming roughly 8.7 billion gallons of ethanol annually (11.7 billion gallons of E85).[51]

In addition, based on data from Edmunds, EPA's MOVES model and other sources, we estimate approximately 83 percent of current light-duty automobiles in service were built in 2001 or later, meaning four out of every five cars and light trucks on the road are approved by EPA to use E15. Further, the use of E15 is explicitly approved by the manufactures of 60 percent of model year (MY) 2014 and 2015 light-duty vehicles sold in the United States.[52] Automakers

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[49] 80 Fed. Reg. 33,122

[50] DOE Alternative Fuels Data Center, *Flexible Fuel Vehicles*, available at http://www.afdc.energy.gov/vehicles/flexible_fuel.html

[51] Assumes average annual fuel consumption per vehicle is 600 gallons. Assumes E85 average ethanol content of 74%.

[52] The 60% figure was derived by examining automaker warranty statements for MY2014 and MY2015 vehicles and automotive sales market share data provided by Motor Intelligence. A full list of recommended gasoline language from MY2012-15 warranty statements is available at

offering unequivocal E15 warranty coverage for some or all of their MY2014 and MY2015 vehicles include Audi, General Motors, Ford, Toyota, Lexus, Honda, Acura, Volkswagen, Mercedes-Benz, Jaguar, Porsche, and Land Rover. Moreover, all automakers manufacturing FFVs, including Chrysler and Nissan, warranty the use of E15 in FFV models.

The oil industry is correct that E15 is not explicitly addressed in warranty statements and owners' manuals for automobiles built before 2011, but *that's because E15 did not exist as a legal fuel in the marketplace at the time those vehicles were built and their warranty statements were printed*. As a general matter of policy, automakers do not modify or change vehicle warranties retroactively based on changes in the fuels marketplace. Thus, it is simply incorrect to argue that concern about the effect of E15 on engines is the primary reason that automakers have not retroactively warrantied pre-2011 vehicles for E15. Rather, the reason automakers have not retroactively warrantied pre-2011 vehicles for E15 is that they don't retroactively modify warranties *for any reason*.

In all, the current light-duty automotive fleet has the legal and technical capacity to consume more than *29 billion gallons of ethanol* annually.[53] This capacity will only increase in the future as more FFVs enter the fleet, as the percentage of the fleet represented by vehicles built in 2001 or later continues to grow, and as more new automobiles are explicitly warranted for E15 use. Clearly, the capacity of the existing vehicle fleet to consume ethanol is not a limiting factor that would prevent compliance with the 2014-2016 statutory renewable fuel requirements.

Clearly, the existing vehicle fleet, current and expected refueling infrastructure and carryover RINs are sufficient to facilitate compliance with the statutory renewable fuel requirements in 2014, 2015, and 2016.

V. There is no evidence that changes in RIN prices contribute to higher retail gasoline prices for consumers

In its efforts to undermine the RFS, the oil industry has speciously suggested that higher RIN prices contribute to higher retail gasoline prices, which could result in "harm" to the economy of the United States. Regrettably, based on the interagency review documents available on the docket for the original 2014 RVO proposal, it appears that some in the Administration may have shared the oil industry's position. In reality, there is no evidence that fluctuations in RIN prices have had any impact on retail prices for gasoline (i.e., E10), and in fact there *is* evidence, as discussed in previous sections of these comments, that higher RIN prices result in lower retail prices for fuel blends containing higher levels of ethanol.

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www.ethanolrfa.org. For MY 2015 vehicles, see http://www.ethanolrfa.org/news/entry/automakers-approve-e15-for-use-in-two-thirds-of-new-vehicles/

[53] Assumptions: Current light-duty fleet=230 million vehicles; 73% of existing fleet consumes 600 gallons of E15 per vehicle per year; 10% of existing fleet consumes 700 gallons of E85 (74% ethanol) per vehicle per year; 17% of existing fleet consumes 580 gallons of E10 per vehicle per year.

In a reversal from the original 2014 RVO proposal, EPA now definitively concludes that "the RIN market seems to be functioning generally as expected; providing an incentive for the continued growth of renewable fuels in the transportation fuel market *without causing overall increases to the retail price of transportation fuel."*[54]

EPA's finding is corroborated by analyses conducted by academia and private economic consulting firms:

- Irwin & Good of the University of Illinois examined 2012-2013 prices for CBOB, ethanol and D6 RINs to determine the impact of rising RIN prices on retail gasoline prices.[55] They found that "the basic zero sum nature of relationships in the supply chain and recent price trends for CBOB blendstock and ethanol suggests that the impact, if any, has likely been small, at most a few cents."

- In a May 2015 update to a 2014 study, Informa Economics (Attachment 4) concluded that, "Changes in prices of renewable identification numbers (RINs) did not cause changes in retail gasoline prices from 2013 through the first quarter of 2015."[56]

- Analysis by economists at Iowa State University found that "the most likely outcome from increasing ethanol mandates is a drop in pump prices, not an increase."[57] Further, they concluded, "Many in the oil industry have used the specter of higher pump prices to argue against increased mandates. …These findings show that concern about the consumer price of fuel do not justify a reduction in feasible ethanol mandates."

- Retired Yale and Calgary professor Philip Verleger conducted an economic study that concluded the "RIN price impact on retail prices is small and transient."[58] He found that competition in the gasoline supply chain tends to diminish any price increases when refiners or blenders tried to embed the RIN price into E10 prices.

- EIA confirmed the absence of any connection between RIN prices and retail gasoline prices, stating: "To date, there is no evidence that retail gasoline prices have been affected by high RIN prices. While the cost of refined gasoline blendstock can be affected by high RIN prices, the increased cost to gasoline blenders is almost exactly

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[54] Burkholder, Dallas. "A Preliminary Assessment of RIN Market Dynamics, RIN Prices, and Their Effects," U.S. EPA-Office of Transportation and Air Quality (May 14, 2015). Available at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2015-0111-0062

[55] Irwin, S. & D. Good (Mar. 2013), "High Gasoline and Ethanol RINs Prices: Is There a Connection?" Link: http://farmdocdaily.illinois.edu/2013/03/high-gasoline-ethanol-rins-prices.html

[56] Informa Economics, Inc. (May 2015), "Analysis of Whether the Prices of Renewable Fuel Standard RINs Have Affected Retail Gasoline Prices." Link: http://ethanolrfa.3cdn.net/f1c5dfa9ac9743e9f8_csm6bcb8e.pdf

[57] Pouliot, S. and B.A. Babcock (Jan. 2014). Center for Agricultural and Rural Development (CARD); Iowa State University. "Impact of Increased Ethanol Mandates on Prices at the Pump." CARD Policy Brief 14-PB 18. Link: http://www.card.iastate.edu/publications/synopsis.aspx?id=1218

[58] Verleger, P.K., Jr. (Jan. 2014), "The Renewable Fuel Standard: How Markets Can Knock Down Walls." Link: http://www.pkverlegerllc.com/publications/papers/the-renewable-fuel-standard-how-markets-can-knock-down-walls-january-2014-1162/

offset in 2013 by their increased revenue generated from the sales of RINs separated when they blend ethanol into gasoline."[59]

- Even a former member of President Obama's Council of Economic Advisers, who took part in the interagency review of the original 2014 RVO proposal, recently found that "…the price of E10 does not vary with RIN prices…" and that RIN prices actually serve to "…decreas[e] the price of fuels with high renewable content (like E85)."[60]

Far from leading to higher retail gasoline prices, elevated RIN prices would—as demonstrated elsewhere in these comments—induce expansion of E15 and E85 infrastructure and allow retailers to discount prices for these fuels relative to gasoline.

VI. The Statutory Basis for Granting a General Waiver Based on "Inadequate Domestic Supply" of Renewable Fuels Does Not Allow the Agency to Take Into Account the "E10 Blend Wall" or Perceived Constraints on Distribution Capacity and the Act of "Supplying *to*" Consumers

Even beyond the factual inaccuracies that plague EPA's proposal, there is a fundamental legal infirmity as well: The Clean Air Act does not permit the Agency to take into account perceived "constraints in renewable fuel distribution infrastructure"[61] or "constraints on *supply to* [i.e., distribution to] consumers resulting from the E10 blendwall"[62] in determining whether to grant a general waiver based on an "'inadequate domestic *supply*'" of renewable fuel. Instead, EPA may grant a waiver based on "inadequate domestic supply" of "renewable fuel" only where it finds that the renewable fuel industry lacks the capability to produce the required volumes of renewable fuel, and where there are insufficient carryover RINs available for obligated parties to meet the statutory RVO. The Agency has not made that showing here.

The RFS program was created by the EPAct and expanded by EISA. The purpose of this program is to gradually expand the availability and use of renewable fuels by "replac[ing] or reduc[ing] the quantity of fossil fuel present in transportation fuel."[63] The program achieves this purpose by requiring that domestic producers and distributors of transportation fuel make available steadily increasing volumes of renewable fuels each year, and by imposing penalties on obligated parties who fail to achieve these requirements through generating or purchasing

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[59] Presentation by Mindi Farber-DeAnda, EIA Office of Petroleum, Natural Gas, and Biofuels Analysis to Advanced Biofuels Association (Nov. 20, 2013). Washington, D.C.

[60] Stock, James H. (April 2015). Columbia SIPA Center on Global Energy Policy. "The Renewable Fuel Standard: A Path Forward." Available at: http://energypolicy.columbia.edu/sites/default/files/energy/Renewable%20Fuel%20Standard_A%20Path%20Forward_April%202015.pdf

[61] 80 Fed. Reg. 33,100

[62] 80 Fed. Reg. 33,109

[63] Clean Air Act § 211(*o*)(1)(J) (defining renewable fuel to mean "fuel that is produced from renewable biomass and that is used to *replace or reduce* the quantity of fossil fuel present in transportation fuel" (emphasis added)) (codified at 42 U.S.C. § 7545(*o*)(1)(J)).

credits, called RINs, based on the quantity of renewable fuel that is produced, blended, or imported.[64]

Consistent with Congress's overarching goal—to force the transportation-fuel industry to increasingly replace fossil fuel with renewable fuel—the RFS program authorizes EPA to grant a waiver from its requirements in two carefully and *narrowly defined* situations:

- if there is an "inadequate domestic supply" of renewable fuel, Clean Air Act § 211(*o*)(7)(A)(ii) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(ii)), or

- if the implementation of the requirement would "severely harm the economy or environment of a State, a region, or the United States," *id.* § 211(*o*)(7)(A)(i) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(i)).

In the proposed rule, EPA has not claimed that the 2014-2016 RVO would "severely harm" the economy or environment of a State, region, or the United States—and for good reason. The Administrator could not credibly claim that implementation of the statutory RVOs would lead to such a severe harm to the economy or the environment. Indeed, ethanol remains the least expensive motor fuel and octane source in the world today.

Instead, EPA inexplicably suggests that the statutory term "inadequate domestic supply" somehow includes "factors affecting the ability to *distribute*, *blend*, *dispense*, and *consume* those renewable fuels in vehicles."[65] EPA also claims that it may "…consider supply in terms of distribution and use by the ultimate consumer…"[66] But the Agency is mistaken for two reasons. *First*, as explained above, EPA is factually incorrect. There are no barriers or "practical constraints" on consumption that could justify a waiver of the RVO for renewable fuel, even if such barriers were an allowable waiver consideration. *Second*, and more fundamentally, the term "supply" in 211(*o*)(7)(A)(ii) is a noun referring to a physical quantity of renewable fuel and cannot be read as a verb (i.e., as in "supply to") that implicitly includes considerations of distribution and consumption. Further, the phrase "renewable fuel" requires the Agency to take into account the availability of carryover RINs in meeting the RVO.

Taken together, this means that considerations of consumption and distribution are irrelevant. Instead, EPA's sole focus should be on whether there is an insufficient quantity of renewable fuel available—based on the capacity to produce renewable fuel, projections of actual production, and carryover RINs—such that obligated parties could not satisfy the statutorily prescribed RVO.

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[64] *See* Clean Air Act § 211(*o*)(2)(B)(i)(I) (increasing the statutorily mandated volumes each year) (codified at 42 U.S.C. § 7545(*o*)(2)(B)(i)(I)); *id.* § 211(*o*)(5) (establishing a credit program) (codified at 42 U.S.C. § 7545(*o*)(5)); *see also id.* § 211(d)(1), (2) (providing for the imposition of civil penalties and injunctive relief based on noncompliance with the requirements of the RFS program) (codified at 42 U.S.C. § 7545(d)(1), (2)).

[65] 80 Fed. Reg. 33,111

[66] 80 Fed. Reg. 33,113

a. The phrase “inadequate domestic supply” of “renewable fuel” is unambiguous, and requires the Agency to find both an inadequate capacity to produce renewable fuels, along with insufficient carryover RINs available to meet the RVO.

As noted above, the Clean Air Act authorizes EPA to grant a general waiver to “reduc[e] the national *quantity of renewable fuel* required under [the RFS Program] . . . based on a determination . . . that there is an inadequate domestic *supply*.” Clean Air Act § 211(*o*)(7)(A)(ii) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(ii)) (emphasis added). There can be no doubt that the phrase “inadequate domestic supply” refers to the available quantity of renewable fuel based on production capacity and carryover RINs—and nothing more.

In interpreting the phrase at issue, EPA is required to follow the well-known, two-step framework established in *Chevron, U.S.A., Inc. v. Natural Resources Defense Council*, 467 U.S. 837 (1984). First, the Agency must determine “whether Congress has directly spoken to the precise question at issue.” *Id.* at 842. “If the intent of Congress is clear, that is the end of the matter; for the court[s], as well as the agency, must give effect to the unambiguously express intent of Congress.” *Id.* at 842-43. If, however, the intent of Congress is not clear, only then may the Agency continue to *Chevron*’s second step. Under that second step, a court will defer to an agency’s interpretative choice if it “‘represents a reasonable accommodation of conflicting policies that were committed to the agency’s care by the statute.’” *Id.* at 845.

Before proceeding to *Chevron*’s second step, EPA must “employ[] traditional tools of statutory construction” to ascertain congressional intent. *Id.* at 843 n.9. This includes not only a searching inquiry of the statute’s underlying text, but also an understanding of its overarching purpose and the legislative history of the phrase or provision at issue. Indeed, beginning with *Chevron* itself, the Supreme Court has considered a statute’s “legislative history” among the “traditional tools of statutory construction” that must be considered at *Chevron*’s first step. *Id.* at 843 n.9, 851-60 (analyzing the “legislative history” of the Clean Air Act at *Chevron*’s first step); *see also Gen. Dynamics Land Sys. v. Cline*, 540 U.S. 581, 600 (2004) (“deference to [an agency’s] statutory interpretation is called for only when the devices of judicial construction have been tried and found to yield no clear sense of congressional intent”); *id.* at 586-91 (using legislative history to determine congressional intent at *Chevron*’s first step); *cf. Nat’l Cable & Telecomms. Ass’n v. Brand X Internet Servs., Inc.*, 545 U.S. 967, 989, 992 (2005) (concluding that the statute in question was ambiguous, “not only from the ordinary meaning” of the language, “but also from the *regulatory history* of the Communications Act,” which effectively served as that statute’s legislative history, because “Congress passed the definitions in the Communications Act against the background of this regulatory history” (emphasis added)).

Here, the text, purpose, and legislative history of the general waiver provisions, along with the structure of the Clean Air Act more generally, all lead to the same conclusion: the term “supply” refers to the available stock (or quantity) of renewable fuel based on production capacity and carryover RINs, and does not include concepts traditionally associated with “consumption” or the act of “supplying [a commodity] to” the end user. Here, EPA’s interpretation of the general waiver provision unquestionably fails *Chevron*’s first step.

i. A plain reading of the phrase "supply" of "renewable fuel" means the physical quantity of renewable fuel and any available carryover RIN credits.

The general waiver provision authorizes the Administrator to grant a waiver to "reduc[e] the national *quantity* of *renewable fuel* required under [the RFS program] . . . based on a determination . . . that there is an inadequate domestic *supply*." Clean Air Act § 211(*o*)(7)(A)(ii) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(ii)) (emphasis added). As explained below, the key statutory phrase—"inadequate domestic supply" of "renewable fuel"—refers to the availability of renewable fuel as a commodity based on projected production capacity and existing stocks of carryover RIN credits. It does not embrace concepts of "consumption."

Although the phrase "inadequate domestic supply" is not explicitly defined in the statute, the term "supply" has a settled meaning in everyday parlance. "Supply" is a noun meaning "the quantity or amount (as of a commodity) needed or available." NEW MERRIAM-WEBSTER DICTIONARY 721 (1989). EPA itself admits that this is the "common understanding of this term…"[67] The term "supply" is therefore distinct from the concept of "consumption," which focuses instead on "the act of consuming or using up." NEW MERRIAM-WEBSTER DICTIONARY 172 (1989). EPA has further attempted to conflate "supply" with "distribution" or "consumption" by suggesting the term should be read as a verb (i.e., "to supply"), then arguing that there are "practical and legal constraints" that prevent adequate supplies of renewable fuel from being "supplied to" consumers. EPA's tenuous attempt to redefine "supply" is an obvious affront to the plain statutory language established by Congress.

The waiver provision also speaks to a commodity, "renewable fuel." It authorizes the Administrator to grant a waiver of the required "quantity" of "renewable fuel" only where there is an "inadequate domestic supply"—*i.e.*, an insufficient amount available—of that commodity to satisfy the RVO's yearly requirements. Clean Air Act § 211(*o*)(7)(A)(ii) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(ii)).

The commodity itself, "renewable fuel," is defined to mean two things. First, "renewable fuel" includes the physical gallons of "fuel that is produced from renewable biomass and that is used to replace or reduce the quantity of fossil fuel present in a transportation fuel." *Id.* § 211(*o*)(1)(J) (codified at 42 U.S.C. § 7545(*o*)(1)(J)). Second, "renewable fuel" includes any carryover RINs, which are meant to represent "a quantity of renewable fuel that is greater than the quantity required" in a given year. *Id.* § 211(*o*)(5)(A)(i) (codified at 42 U.S.C. § 7545(*o*)(5)(A)(i)); *see also* 40 C.F.R. § 80.1401 (defining a RIN to mean "a unique number generated to represent a volume of renewable fuel").[68]

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[67] 80 Fed. Reg. 33,111

[68] EPA has itself adopted this interpretation of the commodity at issue. In interpreting the parallel waiver provision that governs cellulosic biofuel, EPA considered both the projected availability of physical gallons of advanced biofuel and the "significant number of carryover RINS available" to help meet that year's RVO. EPA, *Regulation of Fuels and Fuel Additives: 2013 Renewable Fuel Standards*, 78 Fed. Reg. 49,794, 49,797 (Aug. 15, 2013).

As a result, EPA must take into account both the physical gallons of renewable fuel that may be available in a given year, based on production capacity, along with any carryover RINs that are available to obligated parties to meet their obligations under the statutorily-prescribed RVO. In other words, even if the renewable fuel industry's projected capacity falls short of the RVO for a given year (or if those projected totals somehow do not count towards the available "supply" of "renewable fuel"), the Agency would still be obligated to take into account the availability of carryover RINs. Those RINs represent a volume of renewable fuel that may be credited towards an obligated party's obligation under the RVO for a given year. *See* Clean Air Act § 211(*o*)(5) (codified at 42 U.S.C. § 7545(*o*)(5)). Thus, carryover RINs form a component that must be included in determining whether there is an "inadequate domestic supply" of "renewable fuel" sufficient to grant a general waiver. Indeed, it would make no sense to interpret the RFS program to provide that a party may satisfy its obligation using carryover RINs, but then suggest that carryover RINs should not factor into whether it is appropriate to grant a waiver from those obligations.

Fundamentally, EPA may grant a waiver only where there is an "inadequate domestic supply" of the total "quantity" of "renewable fuel"—that is, the projected capacity of the renewable-fuel industry to produce physical gallons during the year in question *and* any carryover RINs that are available to obligated parties. Clean Air Act § 211(*o*)(7)(A)(ii) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(ii)); *see also id.* § 211(*o*)(5)(A)(i) (codified at 42 U.S.C. § 7545(*o*)(5)(A)(i)).

ii. EPA's proposed interpretation of "Inadequate Domestic Supply" is not supported by Congressional intent of the RFS program

Even if the term "supply" could be said to embrace the much broader "factors affecting the ability to distribute, blend, dispense, and consume…renewable fuels in vehicles," such an interpretation is contrary to the purpose of the RFS program. The purpose behind the RFS program generally, and the waiver provision in particular, supports a commodity-driven definition of supply—one that accounts for only a shortage of renewable fuel, but does not take into account the infrastructure needed to distribute it to consumers. The very purpose of the RFS program was to "replace or reduce the quantity of fossil fuel present in a transportation fuel." Clean Air Act § 211(*o*)(1)(J) (codified at 42 U.S.C. § 7545(*o*)(1)(J)). The program achieves this purpose by requiring that the "transportation fuel sold or introduced into commerce in the United States . . . contains at least the applicable volume of renewable fuel" set out in the statutory RVO provision, Section 211(*o*)(2)(B). *Id.* § 211(*o*)(2)(A)(i) (codified at 42 U.S.C. § 7545(*o*)(2)(A)(i)).

Properly understood, the RFS program was designed to force the oil industry to change the status quo—not to perpetuate it. The only way that the oil industry can achieve the ever-increasing volume requirements is to invest in new infrastructure capable of distributing, blending, and dispensing renewable fuels. Congress, in its wisdom, did not dictate how the oil industry would achieve these goals; instead, it published the targets well in advance of implementation and provided penalties for noncompliance. *See* Clean Air Act § 211(o)(5) (establishing a credit program) (codified at 42 U.S.C. § 7545(o)(5)); *see also id.* § 211(d)(1), (2) (providing for the imposition of civil penalties and injunctive relief based on noncompliance with the requirements of the RFS program) (codified at 42 U.S.C. § 7545(d)(1), (2)). The threat of financial penalties would be an empty one if EPA could simply grant a waiver based on the oil industry's refusal to help put in place the infrastructure needed to distribute, blend, and dispense renewable fuels to consumers.

And yet, that is exactly what EPA has proposed here. The Agency claims that, because there is insufficient "infrastructure" in place to ensure the consumption of the required volumes of renewable fuels—infrastructure that, paradoxically, the oil industry was obligated to help create—the oil industry should receive a waiver of its obligations under the RFS program. That interpretation would do violence to the purpose of the RFS Program.

The entire purpose of this program would be subverted if the oil industry is awarded a waiver after it failed to take the steps necessary to ensure that it was capable of distributing, blending, and dispensing the supply of renewable fuel required under the statute. Indeed, it should come as no surprise that the oil industry has actively resisted providing the infrastructure necessary to meet the RFS program's mandate to "replace or reduce the quantity of fossil fuel present in a transportation fuel." Clean Air Act § 211(*o*)(1)(J) (codified at 42 U.S.C. § 7545(*o*)(1)(J)); *see also* H.R. Rep. No. 109-215, pt. 1, at 169 (2005) (stating that that the RFS program "encourages the use of alternative transportation fuels"). Every gallon of renewable fuel that replaces a gallon of fossil fuel is a gallon less sold by the oil industry. Congress knew that the industry had no incentive to reduce America's dependence on fossil fuel on its own, so it provided a rigid program to force the industry to make renewable fuels available or pay statutory penalties.

Viewed in this light, it is apparent that Congress intended to allow EPA to grant a waiver only in two narrow situations—both where continued compliance with the statutory RVO would be beyond the oil industry's control. First, it would be unfair to penalize the oil industry if there was an inadequate domestic supply of the renewable fuel and RIN credits available to meet the requirements of the RFS program. As a result, Congress authorized EPA to grant a waiver if the available supply of renewable fuel and credits was inadequate to meet the program's requirements. *Id.* § 211(*o*)(7)(A)(ii) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(ii)). Second, Congress provided waiver authority where continued compliance with the RVO might cause economic or environmental harm. *Id.* § 211(*o*)(7)(A)(i) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(i)). But to stave off perpetual claims by the oil industry—that implementing the RVO would, itself, amount to economic harm—Congress set an extremely high bar: the Administrator must find that continued compliance would cause "severe" economic or environmental harm to a State, region, or the United States. *Id.*

Beyond these narrow exceptions, Congress provided no avenue for the Administrator to waive the requirements of the RVO as it applies to the undifferentiated renewable fuel portion of the RFS. And here, the only obstacles to continued compliance are those that the oil industry has itself erected. For instance, the industry could have easily supported efforts to install blending infrastructure straight at the pump, which would facilitate the distribution of blends greater than E10. Indeed, virtually every fueling station in the country has storage tanks capable of holding the regular gasoline and renewable fuels needed to produce blends greater than E10 straight at the pump.[69] But allowing its franchisees to install these blending pumps would mean that the oil industry would sell less fossil fuel—the very purpose of the RVO, Clean Air Act § 211(*o*)(1)(J) (codified at 42 U.S.C. § 7545(*o*)(1)(J)) (providing that renewable fuel was meant to "replace or reduce the quantity of fossil fuel present in a transportation fuel"). Granting a waiver now would subvert the very purpose of the RFS program: change or face penalties.

It is apparent from these provisions that Congress authorized EPA to grant a waiver *only* to address circumstances that are beyond the oil industry's capacity to control. EPA's proposal, in contrast, would provide a waiver to the industry for circumstances that the industry was capable of preventing. Indeed, the oil industry has had numerous opportunities to help ensure the distribution, blending, and dispensing of renewable fuel. Thus, to the extent that the "blend wall" is a crisis at all, it was one that the oil industry has inflicted upon itself. This is not a basis for a waiver.

iii. EPA's proposed use of its general waiver authority is not supported by the legislative history of the RFS program

The legislative history of the RFS program likewise makes plain that EPA cannot permissibly read the term "supply" to include factors of consumption or the act of "supplying *to*" consumers. Congress expressly rejected such an interpretation.

There were numerous proposals before Congress that would have authorized EPA to grant a waiver where "there is an *inadequate* domestic supply or *distribution capacity* to meet the requirement." S. Rep. No. 109-74, at 62 (2005) (emphasis added); *see also id.* at 8 (authorizing a waiver where "there is an inadequate domestic supply or distribution capacity to meet the renewable fuel requirement"). In fact, there were numerous proposals before Congress that would have allowed EPA to take into account "distribution capacity."[70] Plainly, this language would have permitted EPA to take into account factors of consumption, along with circumstances that the oil industry was itself capable of rectifying on its own.

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[69] See K. Moriarty & J. Yanowitz. May 2015. *E15 and Infrastructure*. Available at: http://www.nrel.gov/docs/fy15osti/64156.pdf

[70] *See* Energy Policy Act of 2005, H.R. 1640, 109th Cong. § 1501 (2005) (as introduced, but amended to strike "distribution capacity" before it was enacted into law); *see also* New Apollo Energy Act of 2005, H.R. 2828, 109th Cong. § 701 (2005) (proposing to allow EPA to take into account "distribution capacity"); Reliable Fuels Act, S. 606, 109th Cong. § 101 (2005) (same); Energy Policy Act of 2004, H.R. 4503, 108th Cong. § 1501 (2004) (same); Energy Policy Act of 2003, S. 2095, 108th Cong. § 1501 (2004) (same); Energy Independence Act of 2004, H.R. 4652, 108th Cong. § 101 (2004) (same); Fuels Security Act of 2003, H.R. 837, 108th Cong. § 101 (2003) (same); Fuels Security Act of 2003, S. 385, 108th Cong. § 101 (2003) (same); Energy Policy Act of 2003, H.R. 1644, 108th Cong. § 9101 (2003) (same); Energy Policy Act of 2003, H.R. 6, 108th Cong. § 820 (2003); H.R. 1020, 108th Cong. § 5 (2003) (same); Energy Policy Act of 2002, S. 1766, 107th Cong. § 818 (2001) (same); H.R. 3596, 107th Cong. § 5 (2001) (same); Clean and Renewable Fuels Act of 2001, S. 892, 107th Cong. § 10 (2001) (same); Renewable Fuels Act of 2001, S. 670, 107th Cong. § 6 (2001) (same); Renewable Fuels Act of 2000, S. 2503, 106th Cong. § 5 (2000) (same); Clean and Renewable Fuels Act of 2000, S. 2971, 106th Cong. § 10 (2000) (same); 151 Cong. Rec. H2192, H2286 (daily ed. Apr. 20, 2005) (similarly proposing that EPA be authorized to grant a waiver where "there is an inadequate domestic supply or distribution capacity to meet the requirement").

But Congress *rejected* these proposals. Instead, it limited EPA's waiver authority to situations where *external factors* would make it difficult for the oil industry to meet its requirements under the Act—such as "severe" economic harm or an inadequate physical "supply" of renewable fuel necessary to meet the RFS program's requirements. The failure of the oil industry to put in place the infrastructure necessary to sell this supply is plainly not a factor that Congress provided for authorizing a waiver.[71]

iv. Other Clean Air Act waiver provisions demonstrate that Congress has clearly distinguished the concept of "supply" from concepts of "distribution", "consumption", and the act of "supplying to"

Beyond the legislative history of the RFS program's general waiver provision, the structure of the Clean Air Act establishes that Congress did not intend for EPA to take into account "distribution capacity" or purported "constraints on supplying[ing] to consumers" when deciding whether to grant a waiver under the RFS program, because it only permitted EPA to take into account whether the physical "supply" of renewable fuel is adequate to meet the requirements. In contrast, when Congress has wished to provide EPA with the authority to take into account "distribution capacity" or "capacity to supply," it has done so explicitly.

EPA tries to resuscitate its proposed interpretation of "supply" by looking to the structure of the Clean Air Act, but this again leads the Agency to a backwards conclusion. More specifically, EPA concedes that the term "supply" is referenced in other sections of the Clean Air Act, and in each of those instances, Congress also used specific additional language allowing the Agency to take into account concepts associated with distribution capacity. *CITE.*

- Clean Air Act § 211(k)(6) provides EPA with the authority to defer certain reformulated gasoline (RFG) requirements if "there is insufficient domestic capacity to produce reformulated gasoline," and *separately* grants EPA the authority to defer certain RFG requirements if the Agency finds there is "insufficient capacity to supply reformulated gasoline." Clearly, Congress in this case distinguished between the market's ability to produce *a supply* of RFG from the market's ability *to supply* (i.e., distribute or deliver) RFG to consumers.

- Clean Air Act § 211(m)(3)(C)(i) allows EPA to defer certain oxygenated gasoline requirements if the Agency finds "an inadequate domestic supply of, or distribution capacity for, oxygenated gasoline…" This provision clearly demonstrates that Congress distinguished between an "inadequate domestic *supply*" and inadequate "distribution capacity" (or capacity "*to* supply"). EPA itself acknowledges this, stating that "Congress chose to expressly differentiate between 'domestic supply' and 'distribution capacity,' indicating that each of these elements was to be considered separately."[72] The

[71] When then-Senator Obama introduced his version of renewable diesel legislation, he did *not* include a provision authorizing EPA to grant a waiver where there was an inadequate distribution capacity. Instead, his bill provided for a waiver identical to the one that governs the RFS program—where "there is an inadequate domestic supply of renewable fuel." Renewable Diesel Standard Act of 2005, S. 1920, 109th Cong. § 3 (2005).

[72] 80 Fed. Reg. 33,112

surrounding statutory text provides more support for this interpretation. 211(m)(3)(C)(iii) explicitly directs the Administrator to "consider distribution capacity *separately* from the adequacy of domestic supply." Further, 211(m)(3)(C)(iii) specifies that "the term distribution capacity includes capacity for transportation, storage, and blending." Together, these provisions make clear that the general construction of the Clean Air Act has unequivocally separated the concepts of "supply" and "distribution," going so far as to specify what supply chain activities constitute the latter.

- Clean Air Act § 211(c)(4)(C)(ii) gives EPA the authority to waive certain fuel additive requirements if "extreme and unusual" circumstances "…prevent the *distribution* of an adequate supply of the fuel or fuel additive to consumers." Again, the focus of this provision is on the market's ability to *distribute* fuel or fuel additives, highlighting that when Congress intends to provide waiver authority based on distribution capacity, it knows how to do so. Also noteworthy is the fact that Congress specified that distribution *to consumers* is the relevant consideration for this waiver authority. That Congress does not specify "consumers" as the relevant affected party in the RFS general waiver provision undermines EPA's contention that the term "supply" means "supply to consumers." Indeed, even if the term "supply" of "renewable fuel" was intended to encompass the act of "supplying to," any reasonable interpretation would find that the relevant entities to whom renewable fuels are being "supplied" are the parties obligated to demonstrate compliance with the RFS (i.e., oil companies), not consumers. Importantly, CAA §211(c)(4)(C)(ii)(II) provides that EPA may only utilize this waiver authority if the:

> …extreme and unusual fuel and fuel additive supply circumstances are the result of a natural disaster, an act of God, a pipeline or refinery equipment failure, or another event that c*ould not reasonably have been foreseen* or prevented and *not the lack of prudent planning* on the part of the suppliers of the fuel or fuel additive…

In other words, the fuel additive waiver cannot be effectuated by EPA if the cause of the fuel or fuel additive distribution disruption could have been reasonably foreseen. In the case of the RFS, it is inarguable that obligated parties have exhibited a "lack of prudent planning" and could have reasonably foreseen the need to distribute gasoline blends containing more than 10% ethanol in order to comply with the statutory requirements. EPA acknowledges as much, stating, "We agree that obligated parties have had years to plan for the E10 blendwall and that there clearly are steps that obligated parties could take to increase investments needed to increase renewable fuel use above current levels."[73]

Curiously, EPA suggests the structure of the Clean Air Act and the waiver provisions cited above lend support to its definition of "supply" in the proposed rule. However, EPA's examination of these provisions should have led the Agency to the exact opposite conclusion.

[73] 80 Fed. Reg. 33,114

As explained above, Congress plainly knows how to provide EPA with the authority to grant a waiver when there is inadequate distribution capacity, but it did not provide that authority when it enacted the general-waiver provision for the RFS Program. Instead, it merely authorized the Agency to account for "supply," not distribution capacity or "capacity *to supply*." Just as importantly, the term "supply," as it is used in the general-waiver provision, clearly speaks to the "quantity" of "renewable fuel," not to distribution capacity. *Id.*

Moreover, Congress is presumed to give the same word the same meaning in various provisions of the same statute, *IBP, Inc. v. Alvarez*, 546 U.S. 21, 34 (2005), and the Supreme Court have cautioned against interpretations that would render words mere "surplusage," *TRW Inc. v. Andrews*, 534 U.S. 19, 31 (2001). A contrary proposal—reading the word "supply" to include concepts of "distribution capacity" or "supplying to the consumer"—would violate both canons. It would mean that, although "supply" by itself does not embrace "distribution capacity" in other provisions of the same section of the Clean Air Act, the term "supply" as used in the general-waiver provision was meant to do the work of more than one word. *But see* 80 Fed. Reg. at 33,111 (claiming that the other provisions of the Clean Air Act mentioned above highlight the "reasonableness of applying [the term 'supply'] broadly to include adequacy of supply to the ultimate consumer of transportation fuel" based on an inadequate "distribution capacity"). And it would mean that Congress did not have to use words that speak to "distribution capacity" in the first place, because the term "supply" was capable of doing that work on its own.

EPA appears to fault a literal interpretation of the term "supply" because it would mean that, unlike the other waiver provisions recounted above, the general-waiver provision does not authorize EPA to consider "…the full range of constraints that could result in an inadequate supply of renewable fuel to the ultimate consumers, including fuel infrastructure and other constraints." But that is the precise consequence of Congress's choice of words. The Agency cannot supplant its own view of wise policy for that of Congress's simply because it disagrees with the outcome. *E.g.*, *Chevron*, 467 U.S. at 842-43.

Plainly, Congress knows how to provide EPA with the authority to grant a waiver when there is inadequate *distribution capacity*, but it did not provide that authority when it enacted the general waiver provision for the RFS program. Instead, it merely accounted for "supply" unmoored from concepts of distribution capacity. Clean Air Act § 211(*o*)(7)(A)(ii) (codified at 42 U.S.C. § 7545(*o*)(7)(A)(ii)). Just as importantly, these other provisions confirm what is already apparent from the text of the statute itself: The term "supply" has a meaning that is distinct from "distribution capacity" or the act of "supplying to"; otherwise it would have been unnecessary for Congress to distinguish between "supply" and "distribution capacity."

In the final analysis, there is simply no way to read the term "supply," as used in the general waiver provision, to embrace concepts associated with "distribution capacity" or the act of "supplying to" the consumer. If Congress had wanted to embrace those latter concepts, it knew how to do so.

VII. Conclusion

For all of the reasons set forth in these comments, EPA must reconsider its proposal. The Agency should apply only a cellulosic waiver to the 2014-2016 statutory volumes and carry the full amount of that waiver through to both the advanced and total renewable fuel standards. When actual and expected volumes of renewable fuel production in 2014-2016 are considered along with carryover RIN stocks and the likelihood of modest growth in E15 and E85 sales, the total renewable fuel volumes after the cellulosic waiver are undoubtedly "reasonably achievable" without the Agency needing to invoke its general waiver authority in a way that is clearly unlawful and contrary to Congressional intent with the RFS program.

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Feasibility and Cost of Increasing US Ethanol Consumption Beyond E10

by Bruce A. Babcock and Sebastien Pouliot

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Feasibility and Cost of Increasing US Ethanol Consumption Beyond E10

By Bruce Babcock and Sebastien Pouliot

Executive Summary

The proposed decision by the Environmental Protection Agency (EPA) to reduce biofuel mandates that can be met by ethanol to about 13 billion gallons is predicated in part on a finding that consumption of ethanol is largely limited to the amount that can be consumed in E10, a blended fuel containing 10 percent ethanol. One way to increase ethanol consumption beyond E10 levels is with E85, which contains up to 83 percent ethanol. Historical consumption of E85 provides a poor predictor of the level of possible consumption because the price of E85 has never been low enough to save owners of flex vehicles money. We use a new model of E85 demand to estimate the feasibility and cost of meeting higher ethanol mandate levels than those proposed by EPA.

Our model shows that if existing E85 stations could sell as much E85 as demanded by consumers, and if E85 were priced at fuel-cost parity with E10, then ethanol consumption in E85 would be 1.65 billion gallons. If E85 were priced to generate a 20 percent reduction in fuel costs to consumers, then ethanol consumption would increase by 3.6 billion gallons per year. These calculations assume no growth in the number of flex vehicles above the level that existed on January 1, 2013. However, it is not realistic to assume that existing E85 stations could sell unlimited amounts of the fuel. Imposing an upper limit on monthly E85 sales of 45,000 gallons per station reduces ethanol-in-E85 consumption levels to 700 million gallons per year at parity prices, and 900 million gallons per year at a price that results in a 20 percent reduction in fuel costs. The large gap between how much E85 would be demanded by consumers and what can realistically be sold by existing stations shows that both price and the number of gasoline stations selling E85 constrain consumption.

We show the impact of adding E85 sales outlets in urban areas where flex vehicles are concentrated by calculating the different combinations of new sales outlets and E85 retail prices needed to achieve a ethanol consumption targets beyond E10. An additional ethanol consumption target of 800 million gallons could be achieved with an E85 retail price of $2.32 per gallon and no new stations. If 500 new stations were added, then the required retail price increases to $2.71 per gallon. These results demonstrate that meeting a 14.4 billion gallon ethanol mandate is feasible in 2014 with no new stations, modestly lower E85 prices, and judicious use of available carryover RINs (Renewable Identification Numbers).

Meeting a two billion gallon increase in consumption would require installing at least 3,000 new stations. At a cost of $130,000 per station, this would require a one-time investment of $390 million, or about 20 cents per gallon of increased ethanol consumption in one year. With 3,000 additional stations, the retail price of E85 would have to be discounted to $2.10 per gallon to generate two billion gallons of additional ethanol consumption. With a total of 3,500 new stations, the required E85 retail price increases to $2.60 per gallon.

The large impact that adding new stations has on the retail price of E85 given a level of E85 sales gives EPA a powerful tool to incentivize investment in new stations that can

facilitate meeting expanded ethanol consumption targets. Any gap that arises between the wholesale price of ethanol needed to support a lower retail E85 price and the cost of producing and transporting ethanol would be closed by the price of RINs. RIN prices also indicate the cost that owners of oil refineries bear to meet biofuel mandates. Thus, there exists an inverse relationship between the cost of compliance with mandates and the number of new E85 stations. This means that owners of oil refineries who bear the costs of complying with mandates can reduce their compliance costs by investing in new E85 stations.

If EPA were to set the 2014 ethanol mandate at 14.4 billion gallons and the mandate was met by 13 billion gallons of ethanol in E10, 800 million gallons of ethanol in E85, and 600 million banked RINs, then the RIN price that would cover the gap between the required $2.32 per gallon price of E85 and the cost of producing and transporting ethanol would be 69 cents per RIN. With 500 additional stations, the RIN price would drop to 18 cents. This drop in RIN price represents more than a $7 billion drop in the total value of RINs that would be used for compliance in 2014. In this scenario, the cost of adding the additional stations would be $65 million. This dramatic decrease in the total cost of RINs from adding new E85 stations is what gives EPA the tool they need to incentivize the investments that would facilitate expanded ethanol mandates.

EPA's proposed rule would reduce mandated volumes of biofuels in part, because of "supply concerns associated with the blendwall." We demonstrate in this paper that the important supply concern associated with the E10 blendwall pertains to the supply of stations that sell E85, not the supply of the biofuel. The lack of stations that sell the fuel results in a lack of demand for ethanol, not a lack of supply. EPA's justification for reducing ethanol mandates means that mandates will not be increased beyond E10 levels until the number of stations that sell E85 increases sufficiently. Our results demonstrate that the number of stations that sell E85 will not increase until EPA sets ethanol mandates beyond E10 levels. If increased mandates wait for the stations to be built, mandates will never increase.

Our results showing that 800 million gallons of ethanol can be consumed as E85 in 2014, even with no additional investment in E85 stations can provide one way out of this policy dilemma. Combining this additional consumption of ethanol in E85 with consumption of ethanol in E10 and available banked RINs would facilitate meeting a 14.4 billion gallon mandate in 2014. Adopting a 14.4 billion gallon ethanol mandate would send a clear signal that EPA is not locked into keeping ethanol mandates below E10 levels. It would also increase RIN prices enough to incentivize investments in new E85 stations, which would give EPA the freedom to move the ethanol mandate to 15 billion gallons in 2015. Our results show that it will take at least 3,000 additional stations selling E85 to achieve a 15 billion gallon mandate without use of carryover RINs. If all 3,000 stations needed an additional tank for E85, then it will involve a one-time investment cost of approximately $390 million, or about 20 cents for each gallon of ethanol sold in E85. Because this investment cost is far below what compliance costs would be without the investment, owners of oil refineries would have a strong incentive to make the investment.

Introduction

The proposed decision by EPA to reduce biofuel mandates is predicated in part on a finding that consumption of ethanol is largely limited to the amount that can be consumed in E10—commonly referred to as the E10 blendwall. The Energy Information Agency (EIA) reported that in 2013 total motor fuel consumption in the United States would be 134.4 billion gallons, and projected consumption of 134 billion gallons in 2014.[1] EPA thus concluded that consumption of ethanol in 2014 is limited to about 13 billion gallons, which explains why EPA proposed biofuel mandates in 2014 that included 13 billion gallons of ethanol.[2]

EPA recognizes in its proposed rule that some ethanol can be consumed in higher ethanol blends, such as E85. EPA asks for help in identifying data that can be used to estimate more precisely how much ethanol can be consumed in higher blends. Data on historical consumption of E85 in the United States published by EIA shows E85 consumption of 190 million gallons in 2011. One reason for this low level of consumption is that only owners of flex-fuel vehicles can use the fuel. Although there were approximately 15 million flex vehicles on the road in 2013, most are located in major metropolitan areas without easy access to stations that sell E85. However, most flex vehicle owners did not fill up with E85 even if they lived close to an E85 station because its price was too high. Because ethanol has a lower energy content than gasoline, the price of E85 must be at least 20 percent lower than the price of E10 to equalize fuel cost per mile traveled.

One reason the price of E85 has been high is that the value of ethanol in an E10 blend does not necessarily reflect its lower energy content because ethanol's high-octane content offers oil refiners and blenders additional value. It is common sense that ethanol will flow to its highest-value use until that use is saturated, and ethanol in E10 is of higher value than ethanol in E85. Another reason for high E85 prices is that the cost of producing ethanol has been higher than the value of ethanol as a straight substitute for gasoline based on energy value. High corn prices from 2010 until the fall of 2013 made it difficult for ethanol to compete with gasoline. The third reason for high E85 prices is that biofuel mandates have been met by levels of ethanol that could be consumed in E10, or by using "banked" ethanol consumption credits (RINs). In 2013 for example, the mandate level that could be met with corn ethanol was set at 13.8 billion gallons. This level will be met with less than 13 billion gallons of ethanol in E10 with the balance coming from banked credits. To date there has never been a need to price E85 at a level that would increase ethanol consumption beyond 13 billion gallons.

The mandate that can be met with corn ethanol was scheduled to increase to 14.4 billion gallons in 2014 and to 15 billion gallons in 2015. The current number of banked ethanol credits is no longer sufficient to allow these mandate levels to be met if ethanol consumption is limited to 13 billion gallons in E10. Thus, the 14.4 billion gallon mandate in 2014 would have created an economic reason for pricing E85 low enough to increase sales. Increased sales of E85 combined with E10 ethanol consumption and some use of banked ethanol consumption credits would have been the least-cost way of meeting the 14.4 billion gallon ethanol mandate in 2014.

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1 See US EIA Short Term Energy Outlook, December 10, 2013.

2 EPA's proposed volumes could result in slightly higher volumes of ethanol being consumed if imported sugar cane ethanol outcompetes biodiesel for the small amount of the proposed advanced mandate that is not made up by biomass-based diesel.

However, under the EPA proposal, the ethanol mandate in 2014 would be reduced to 13 billion gallons—a level that can easily be met with E10. Thus, there would be no policy incentive to increase consumption of E85 under the proposed rule. Our purpose in writing this paper is to examine EPA's assumption that the ability to expand ethanol consumption is so limited that ethanol mandates had to be reduced to the E10 blendwall. We estimate the feasibility and cost of meeting ethanol mandates of 14.4 billion gallons in 2014 and 15 billion gallons in 2015 through a combination of consumption of E10 and E85, and a complete drawdown of banked ethanol consumption credits.

How Much E85 Can Be Consumed?

In the summer of 2013 we built a model of E85 demand in the United States.[3] The demand model accounts for the distance that owners of flex fuel vehicles must drive to find a station that sells E85 and imposes an additional cost of filling up with E85 based on this distance. The model also accounts for differences in the willingness among flex vehicle owners to buy E85 for different price discounts and premiums relative to the price of E10. Data from Brazil were used to estimate these differences. The model assumes that consumers choose whether to use E85 or E10 based on the total cost per mile traveled for the two fuels and based on different non-cost preferences for the two fuels. Thus, the price of E10 is a critical factor in determining the position of the demand curve for E85. Figure 1 shows two demand curves for E85 with existing E85 stations and flex vehicles and fixing the E10 retail price at $3.43 per gallon.[4] The number of flex vehicles is held constant at the level that existed on January 1, 2013.

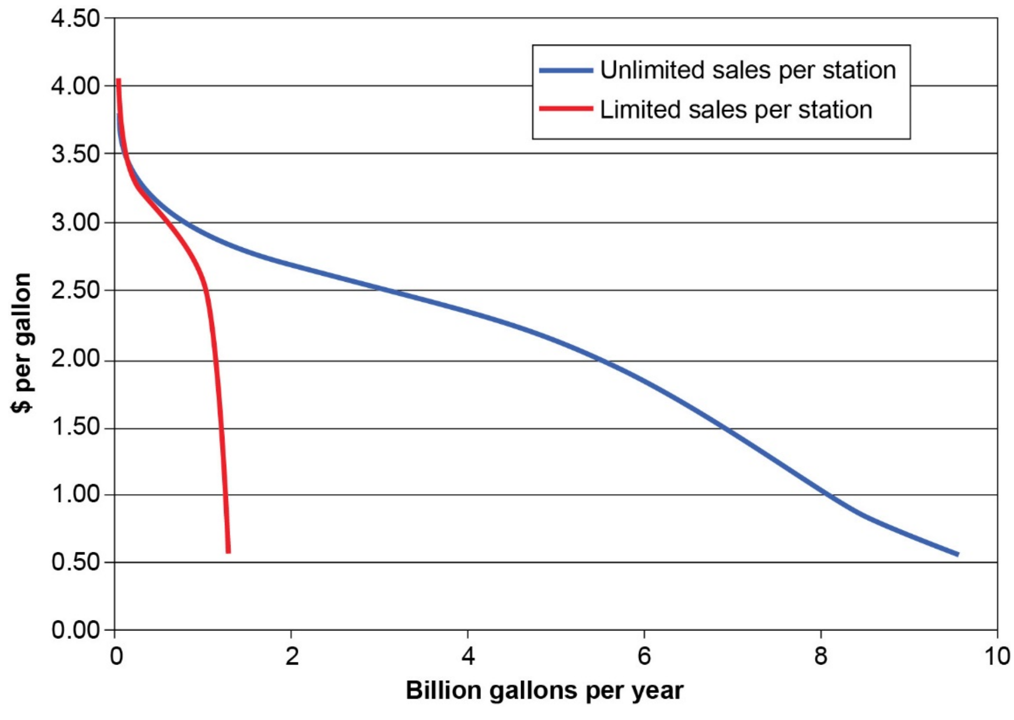

Figure 1. Demand curves for E85 fixing E10 price at $3.43 per gallon

[3] Babcock, B.A., and S. Pouliot. "Price It and They Will Buy." 13-PB 11. Center for Agricultural and Rural Development, Iowa State University. August 2013. This model has recently been revised in response to a request for a revision to a peer-reviewed journal. The revised model was used to generate the results in this paper. Results from the original model would have been very close to those presented here.

[4] In its December, 2013, Short Term Energy Outlook, the US EIA projects that the average US price for regular gasoline in 2014 will be $3.43 per gallon.

The right demand curve in Figure 1 shows the quantity of E85 that would be consumed for different price levels if existing E85 stations could each sell an unlimited amount of E85. At low E85 prices, many stations would have to sell upwards of a million gallons of E85 per month to achieve the consumption levels shown in this demand curve. However, this is an unreasonable assumption because the average amount of fuel sold per station in the United States is about 100,000 gallons per month. The left demand curve assumes that no station can sell more than 45,000 gallons of E85 per month. This is a rather rigid limit, but the most E85 that any station has sold in a month, was about 50,000 gallons, sold in May of 2013 by a station in Minnesota. The distance between these two demand curves shows that the number of stations selling E85 limits consumption more than the number of flex vehicles, because the right demand curve could be achieved by simply locating more E85 stations in the same locations as existing stations. Demand could be increased even more if stations were located more strategically to minimize the distance that owners of flex vehicles had to drive to purchase E85.

Figure 1 shows that E85 sales could reach almost 10 billion gallons per year if there were enough stations selling the fuel, and if the price of E85 was heavily discounted. With a 45,000 gallon monthly sales limit, total consumption of E85 cannot exceed 1.25 billion gallons per year no matter how large a discount is given to the fuel.

Biofuel mandates are expressed in terms of gallons of ethanol consumption per year, not gallons of E85 per year. Figure 2 converts quantities of E85 into quantities of ethanol and converts the price of E85 into the ratio of fuel cost per mile traveled using E85 compared to E10. The fuel-cost parity price of E85 is 77.5 percent of the price of E10 when E85 contains 75 percent ethanol. Thus, the parity price of E85 is $2.66 per gallon when the price of E10 is $3.43 per gallon. What Figure 2 indicates is that if E85 were

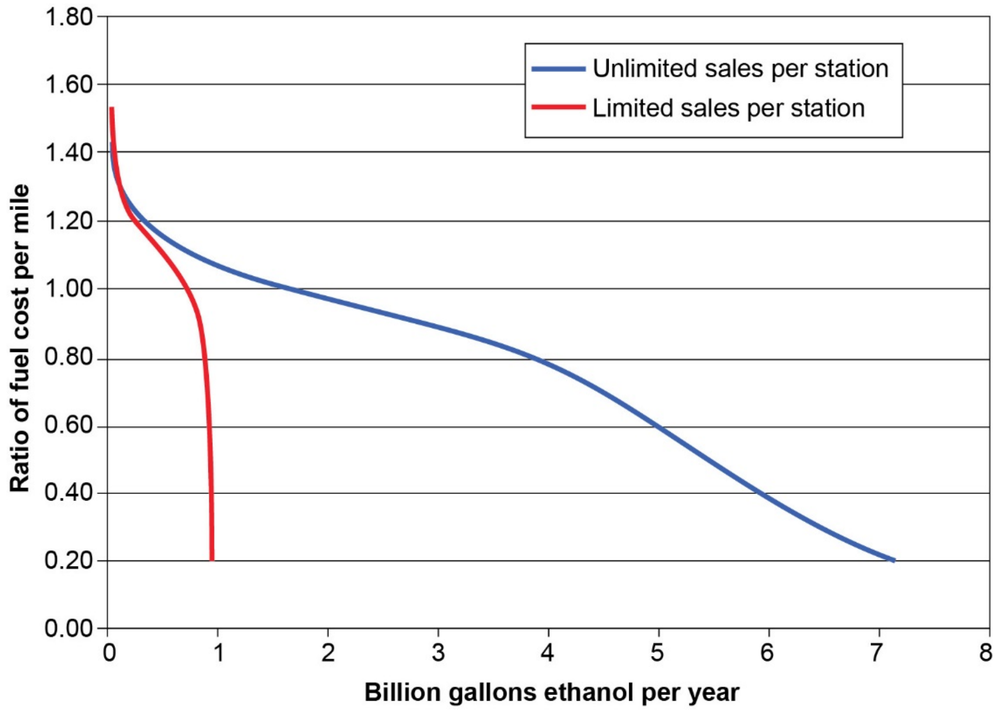

Figure 2. Ethanol consumption levels for different fuel cost ratios

priced at parity with E10 at all stations for an entire year, then about 700 million gallons of ethanol would be consumed in E85 with the 45,000 gallons per month sales limit. Parity pricing would result in about 1.65 billion gallons in ethanol sales without the sales limit. Pricing E85 so that it generates a 20 percent savings in fuel cost would result in 900 million gallons of increased ethanol consumption with the sales constraint in place, and more than 3.6 billion gallons without the sales constraint. These results indicate that the two keys to meeting expanded ethanol consumption levels through E85 are increasing the number of stations that sell the fuel and pricing the fuel at levels where it makes sense for owners of flex vehicles to buy it instead of E10. The next section explores how strategically locating additional stations that sell E85 shifts the demand curves shown in Figure 2.

Impact on Demand for E85 with New Stations

The wide gap between the two demand curves in Figure 2 is an indicator of unmet demand for E85. This unmet demand increases rapidly as the price of E85 falls below parity. This result makes intuitive sense because owners of flex vehicles will want to buy E85 when it saves them money, but they will not buy the fuel if it is not available.

Many E85 stations are at their constrained sales level of 45,000 gallons per month when the price of E85 is at parity with E10. These stations have no incentive to charge any less for the fuel even if the E85 wholesale price drops, because they cannot sell any more. Instead, these stations will simply increase their markup and profits. However, profits to an existing station are a signal to competing stations to start selling the fuel. Areas that have the most unmet demand are the locations where it makes the most sense to locate new E85 stations.

It is straightforward to calculate unmet demand because our demand model calculates the number of flex vehicles in each US zip code that do and do not fill up with E85 for any given price. We created a computer program to rank each zip code according to the number of flex vehicles that do not use E85 at a given price. Those zip codes with the greatest number of such vehicles receive the first E85 stations to be added, and lower-ranked zip codes receive E85 stations in turn. So if we want to estimate the impact of installing an additional 2,500 stations, we first satisfy unmet demand in the highest ranked zip codes, and then keep allocating additional stations to lower ranked zip codes until 2,500 stations are installed. We estimated the impact on demand from adding new stations in increments of 500 stations up to 7,500 stations. The results of adding 500, 1,500, 2,500, and 3,500 stations are shown in Figure 3.[5]

The impact on the quantity of ethanol consumed from adding stations when the price of E85 is priced above parity is small because most flex vehicle owners do not want to purchase E85 when it costs more than E10. However, the impact of adding stations is substantial when E85 is priced at parity or below. For example, adding 500 stations would increase the amount of ethanol consumed in E85 from to 700 to almost 900 million gallons. Adding another 1,000 stations would increase ethanol consumption to 1.26 billion gallons. If 3,500 stations were added, and if ethanol were priced at parity, then 1.9 billion gallons of ethanol would be consumed in E85. This result is notable because this quantity of ethanol almost equals the additional quantity that would need to be consumed as E85 to meet a 15 billion gallon mandate in 2015. As shown in Figure 3 the two ways to increase ethanol consumption in E85 are to expand the number of

[5] If E85 were as widely available as E10, the consumption of E85 at fuel cost parity with E10 would be approximately six billion gallons.

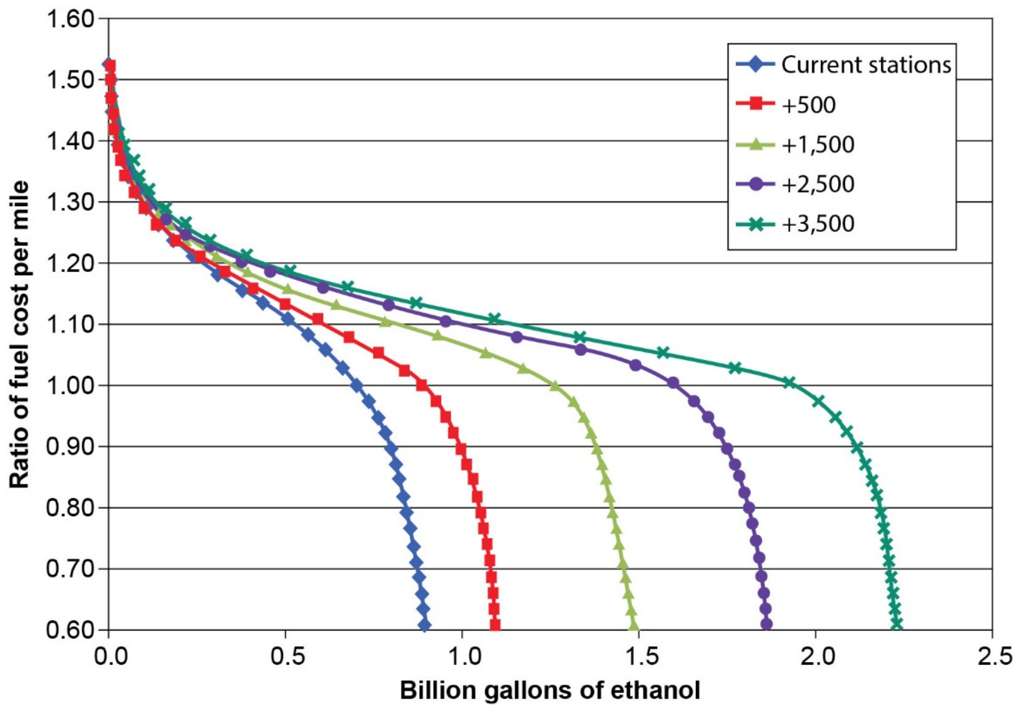

Figure 3. Impact on ethanol demand from adding E85 stations

stations that sell the fuel and to lower its price. It is important to consider the effects of E85 price on consumption levels because EPA has more control over the price of E85 than it does over the number of stations. This influence over price is what gives EPA a powerful policy tool to incentivize the installation of new stations.

How the Price of E85 Reflects Mandate Levels

Compliance with biofuel mandates is achieved by requiring gasoline and diesel producers and importers to acquire and give to EPA enough RINs to meet their obligations. RINs are produced with biofuels and can be acquired either by buying the biofuel or by entering the market for RINs and buying them from a seller. Sellers of RINs are primarily blenders who buy biofuels and the associated RINs. Blenders who have no obligation to meet biofuels mandates have no need for the RINs, so they sell their RINs to owners of oil refineries who face the obligation but do not buy biofuel directly. The price of RINs reflects the incremental financial burden of meeting a biofuel mandate. If a mandate is not a burden to meet then the price of RINs will be low. If a mandate is set at a level that is difficult to achieve then RIN prices will be high.[6]

The economic theory of RIN prices is that they reflect the gap between the incremental market value of a biofuel to a buyer and the cost of producing an incremental amount of the same biofuel. Because production costs increase as more biofuels are produced and because the value of biofuels decreases as more are consumed, the cost-value gap increases with mandate levels. A difficult-to-achieve mandate is reflected in a wide cost-value gap, which implies a high RIN price.

[6] For more details about how compliance costs influence the market price of RINs see Babcock, B.A. "RFS Compliance Costs and Incentives to Invest in Ethanol Infrastructure." 13-PB 13. Center for Agricultural and Rural Development, Iowa State University, September 2013. and Babcock, B.A. and S. Pouliot "RFS Compliance: Death Spiral or Investment in E85." 13-PB 16. Center for Agricultural and Rural Development, Iowa State University.

An example will illustrate how RIN prices reflect this gap: Suppose that EPA decides to impose a13.8 billion gallon ethanol mandate. To meet this mandate will require 13 billion gallons of ethanol consumed as E10 and 800 million gallons consumed as E85. To induce owners of flex fuel vehicles to buy 800 million gallons of ethanol will require pricing E85 at a level that generates a 10 percent savings in fuel cost per mile assuming that no new E85 stations are built, as shown in Figure 3. With a $3.43 per gallon price of E10, this requires an E85 retail price of $2.39 per gallon.

For simplicity, suppose that the markup between wholesale and retail fuel prices is a constant 75 cents per gallon. This means that the wholesale price of E85 must be $1.64 per gallon. If we make the further assumption that the wholesale price equals the weighted average of wholesale ethanol and gasoline prices, and use a $2.68 per gallon wholesale price of gasoline, then this implies that the wholesale ethanol price must be $1.29 per gallon. That is, if the wholesale price of ethanol is $1.29 per gallon and the wholesale price of gasoline is $2.68 per gallon, then the wholesale price of E85 will be $1.64 per gallon if E85 contains 75 percent ethanol. In other words, the only way to induce owners of flex vehicles to buy enough E85 to increases sales of ethanol by 800 million gallons is with a wholesale ethanol price of $1.29 per gallon.

A problem arises if the incremental cost of producing 13.8 billion gallons is greater than $1.29 per gallon. Suppose that the cost of producing and transporting a gallon of ethanol to a blender is $1.80 per gallon. This means that unless the ethanol plant is paid at least $1.80 per gallon for ethanol (and the plant pays for transporting the ethanol to the blender) it will not arrive at the blender. With an ethanol value of only $1.29 per gallon when blended in E85 the blender cannot afford to pay $1.80 per gallon. But the blender can afford to pay $1.29 per gallon for the ethanol and another $0.51 per gallon for the RIN that comes along with the ethanol. The ethanol plant sells both the RIN and the gallon. If the RIN price is $0.51 per gallon and the ethanol price is $1.29 per gallon, together they cover the cost of producing and transporting the ethanol to the blender. It is in this way that the RIN price closes the gap between the cost of producing ethanol and the value that ethanol brings on the market.

Now suppose that EPA is concerned that a RIN price of $0.51 per gallon is too high because owners of oil refineries threaten to pass the cost of these RINs on to consumers through higher gasoline prices.[7] So EPA decides to reduce the ethanol mandate to 13.65 billion gallons. Now only 650 million gallons of ethanol need to be consumed in E85 to meet the mandate. From Figure 3 we can calculate that the retail price of E85 that will result in 650 million gallons of consumption is $2.75 per gallon. This retail price requires a wholesale ethanol price of $1.77 per gallon which is only three cents below the $1.80 cost of production and transportation. The RIN price now needed to ensure that the mandate is met is only three cents per gallon. By lowering the mandate from 750 million gallons to 650 million gallons EPA lowers the RIN price by 48 cents per gallon and increases the E85 retail price by 36 cents per gallon.

Conversely, if EPA were to decide that a 13.8 billion gallon mandate was too modest of a goal and instead set the mandate at 13.9 billion gallons, the required E85 retail price would be $1.54 per gallon. This implies a wholesale ethanol price of only 16 cents per

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[7] For a discussion of why it would be is difficult for oil companies to increase prices to consumers see Babcock, B.A. and S. Pouliot "RFS Compliance: Death Spiral or Investment in E85." 13-PB 16. Center for Agricultural and Rural Development, Iowa State University, November, 2013.

gallon, which in turn implies a RIN price of $1.64 per gallon. Although this last example is quite extreme, it nicely illustrates that by controlling the level of the mandate EPA controls both the price of RINs and the price of E85. This control over RIN prices and E85 prices is what gives EPA the ability to create incentives to meet much higher mandates than could currently be met given current infrastructure. Before demonstrating how, we now turn to identifying feasible compliance paths for increased ethanol mandates in 2014 and 2015.

Feasible Compliance Paths for 2014 and 2015

A combination of banked ethanol credits and new ethanol blending would have been used for compliance if EPA had proposed to maintain the mandates that can be met by corn ethanol for 2014 and 2015 at 14.4 and 15.0 billion gallons, respectively. Paulson recently calculated that there will be at most one billion carryover ethanol RINs that could be used for compliance.[8] However, it is not possible to say exactly how many of these RINs will actually be available to meet 2014 mandates. Suppose that 800 million will be available. If 600 million are used for compliance in 2014 and 200 million in 2015, then to meet a 14.4 billion gallon mandate in 2014 will require physical blending of 13.8 billion gallons of ethanol. To meet a 15 billion gallon mandate in 2015 will require 14.8 billion gallons of physical blending. After 2015 there will be no more carryover RINs available, so 15 billion gallons of ethanol would need to be consumed in 2016.[9] Subtracting 13 billion gallons of E10 from these quantities would mean that as E85 800 million gallons of ethanol would need to be consumed in 2014, 1.8 billion gallons would need to be consumed in 2015, and 2 billion gallons would need to be consumed in 2016.

Recall that that the two ways to increase ethanol consumption through E85 are to lower the price of E85 or to install new E85 stations, or a combination of these two options. The demand curves in Figure 3 can be used to calculate the combinations of E85 prices and new E85 stations that result in the same level of consumption. These combinations are all feasible ways of achieving a given target level of consumption. The results are illustrated in Figure 4 for consumption ranging from 800 million to 2 billion gallons of ethanol consumed in E85, which is in excess of consumption in E10 and carried over RINs.

A target level of consumption of ethanol in E85 of 800 million gallons could be met with no new stations and a pump price of $2.32 per gallon. If 500 new E85 stations were strategically located, then 800 million gallons of consumption could be achieved with a much higher pump price of $2.71 per gallon. Given sales of 800 million gallons of ethanol in E85, the addition of 500 new stations provides more than $400 million in value that can be captured from the sales of E85. These results indicate that it is feasible to meet a 14.4 billion gallon ethanol mandate in 2014 even without any new investments in stations. Adding an additional 500 stations in 2014 would make the target easier to achieve, but the assumption by EPA that a 14.4 billion gallon ethanol mandate in 2014 was not feasible is not correct. A combination of discounted E85 and the judicious use of carryover RINs would have allowed for compliance.[10]

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[8] Paulson's calculations are available at http://farmdocdaily.illinois.edu/2013/12/rin-update-2014-carry-in-epa-rulemaking.html

[9] RINs can be carried over only one year, but owners of RINs can carry over RINs indefinitely by using their oldest RINs first in any given year.

[10] According to a Reuter's report written by Michael Hirtzer, in the summer of 2013 Steve Wall of Protec Fuel was on the verge of selling enough new E85 pumps to two oil refineries to increase the number of stations that sell E85 by 450. This one sale would have accomplished a dramatic decrease in RIN prices. The article is

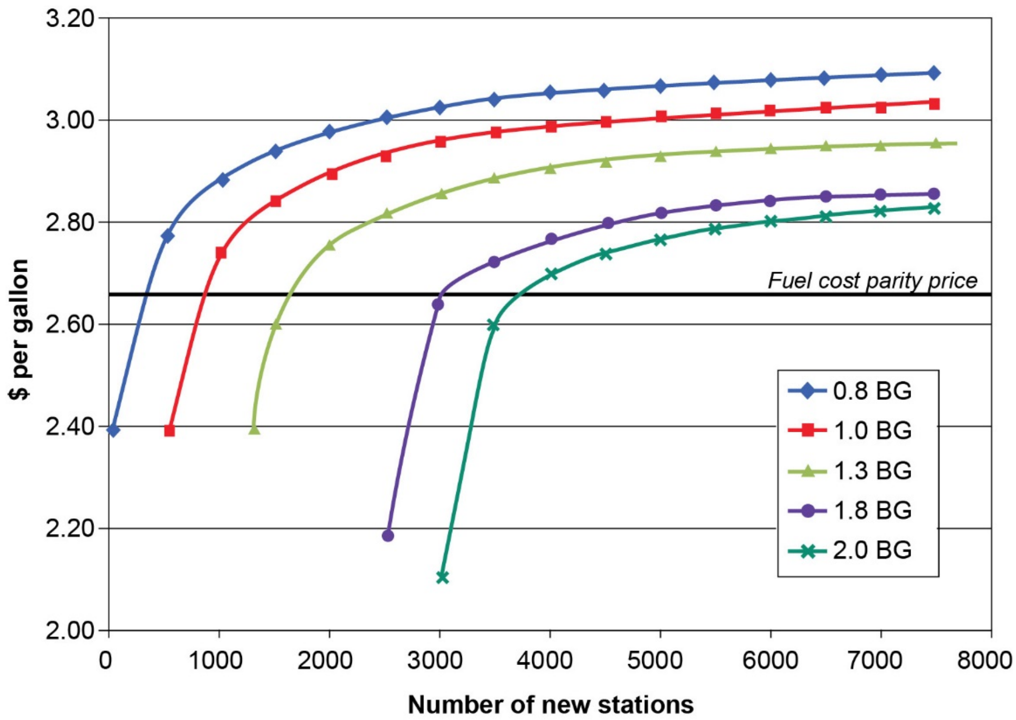

Figure 4. Feasible compliance paths for alternative ethanol volumes

It is not possible to achieve an additional 1.8 billion gallons of ethanol consumption in 2015 without new stations. Figure 4 shows that at least 2,500 new E85 stations would be needed to achieve this level of consumption; and even with this large number of stations the price of E85 would have to be discounted to $2.18 per gallon. If 500 stations were installed in 2014 and 2,500 more installed in 2015, then the price of E85 would only have to be discounted to $2.64 per gallon to achieve 1.8 billion gallons of consumption. If EPA were to conclude that investment in stations could not be achieved this rapidly then it could opt for a lower target for 2015. Two intermediate curves are provided in Figure 4 to facilitate calculation of the retail E85 prices and the number of new stations that sell E85 that would combine to achieve ethanol consumption levels in E85 of 1 and 1.3 billion gallons.

To achieve the 15 billion gallon level of consumption would require a minimum of 3,000 new E85 stations strategically located; and even with 3,000 new stations the price of E85 would have to be discounted to $2.10 per gallon. Adding an additional 500 stations on top of the 3,000 stations would significantly reduce the required E85 discount. This tradeoff between the required price of E85 and the number of new stations selling the fuel is the key to understanding why EPA decisions about mandate levels are so important in determining whether investments in new stations actually occurs. We turn to this issue in the next section.

The results in this section demonstrate that higher ethanol mandates supported by E10 consumption are feasible to achieve. The 14.4 billion gallon mandate level in 2014 is feasible to achieve even if no new E85 stations are added. Adding stations would lower

available at http://www.reuters.com/article/2013/11/27/us-usa-ethanol-e85-analysis-idUSBRE9AQ1AU20131127.

the cost of meeting the 14.4 billion gallon mandate and, more importantly, would allow EPA to increase mandates by even more in the future.

How EPA Decisions Will Determine Investments in New E85 Stations

Compliance with mandates that push ethanol consumption in excess of 13 billion gallons would be accomplished through a combination of lower E85 prices and investment in new E85 stations. Currently there are about 2,500 fuel stations that dispense E85, which is about 2 percent of all US fuel stations. Figure 4 shows that increasing the number of new E85 stations would decrease the discount on the price of E85 needed to achieve consumption of a given amount of ethanol in E85. In addition, for any given number of new E85 stations, discounts on E85 reflect the difficulty in selling larger amounts of ethanol and this in turn causes higher RIN prices. This means that there is an inverse relationship between RIN prices and the number of E85 stations. Because RIN prices measure the incremental cost of compliance with mandates there is also an inverse relationship between the cost of compliance with mandates and the number of new E85 stations. This means that owners of oil refineries who bear the costs of complying with mandates can reduce their compliance costs by investing in new E85 stations. Of course compliance costs would be reduced if any private or public entity increased the number of new E85 stations. Oil refineries just have the largest financial incentive when faced with high RIN prices.

To quantify the tradeoff between RIN prices and the number of new stations requires making some assumptions about the cost of producing ethanol. Table 1 shows the assumptions made here. The minimum price that is needed to deliver ethanol to a blending station given the assumptions in Table 1 is $1.85 per gallon. Ethanol will not be produced and delivered unless blenders pay at least $1.85 per gallon for delivered ethanol. The last assumption that we need before calculating RIN prices is whether retailers will need an additional per-gallon incentive to sell E85 beyond what they receive selling E10. Selling gasoline is a low margin business so adding some additional margin to E85 would increase retailers' willingness to sell the fuel. To ensure that we do not understate required RIN prices we assume that an additional markup of 10 cents per gallon is added to the 75 cent per gallon markup for E10. This additional markup increases RIN prices by 13 cents per gallon.

Table 1. Assumptions about costs of producing ethanol

Prices	
Corn ($/bu)	4.00
Natural Gas ($/mmBTU)	5.60
Dry Distillers Grains ($/ton)	143
Costs and Byproduct Value($/gal)	
Corn	1.43
Natural Gas	0.15
Other Variable	0.30
Transportation	0.40
Total Variable Cost	2.07
Value of Distillers Grains	0.43
Net Cost	1.85

Figure 5 shows the combinations of RIN prices and new E85 stations that are needed to meet alternative ethanol-in-E85 consumption targets. A RIN price of 69 cents per gallon would cover the gap between the cost of producing and transporting ethanol and the wholesale price of E85 that is needed to induce 800 million gallons of beyond-E10 ethanol consumption if no new stations were added. The RIN price would drop to 18 cents per gallon at the same consumption level if 500 new stations were added. If 1.8 billion gallons of additional consumption are needed in 2015 then at least 2,500 additional E85 stations need to be installed. The RIN price with these 2,500 stations would be 97 cents per gallon. If instead 3,000 stations were installed, then the RIN price would drop to 39 cents per gallon.

The dramatic impact that additional E85 stations can have on RIN prices creates a strong incentive for owners of oil refineries to invest in stations to lower their compliance costs. For example, Delta Air Lines owns an oil refinery in Pennsylvania, but does not blend ethanol so it needs to buy RINs to comply with the biofuel volume mandates in the Renewable Fuel Standard (RFS). Because Delta does not sell blended gasoline, it gets no benefit from inexpensive ethanol that offsets high RIN prices, so high RIN prices are a direct additional cost to Delta.

If Delta produces one billion gallons of gasoline per year, it would need to purchase approximately 107 million RINs to be in compliance with an ethanol mandate of 14.4 billion gallons per year in 2014. At a RIN price of 69 cents per gallon, Delta faces compliance costs of $74 million per year. Delta's compliance costs would be reduced by

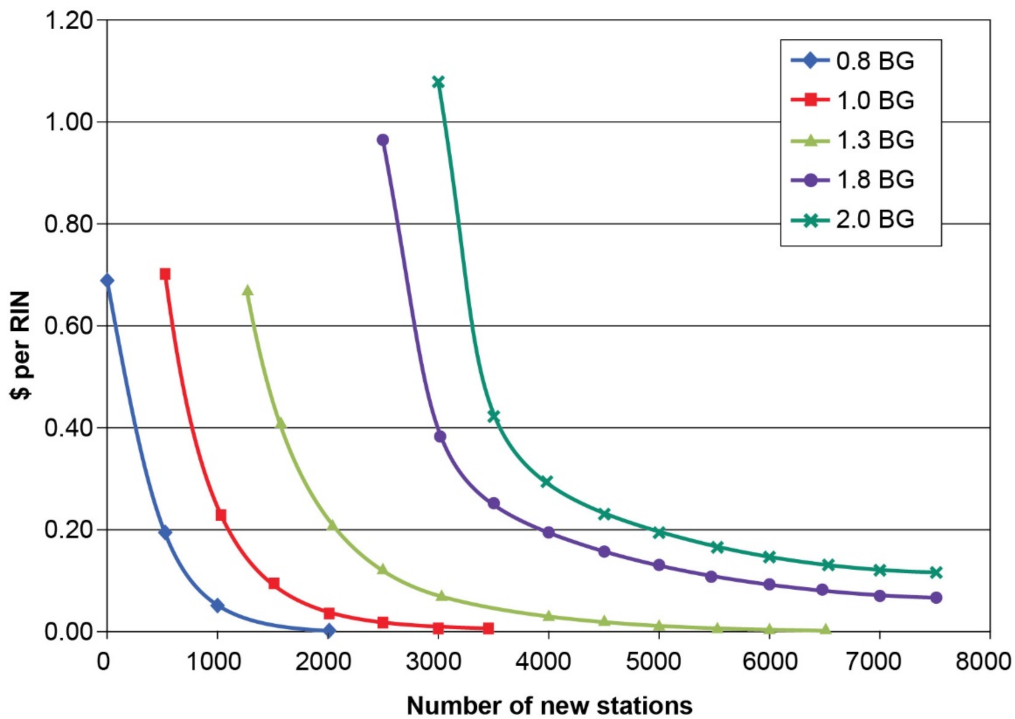

Figure 5. Tradeoff curves between RIN prices and new E85 stations to meet ethanol consumption levels

about $55 million per year if 500 additional E85 stations were strategically located.[11] EPA (2010) estimated that installing a tank and pump to facilitate sales of E85 involves construction costs of $130,000 per station.[12] The cost of installing 500 stations all with

new tanks then is $65 million, which just about balances the one-year reduction in Delta's compliance costs even if Delta gave away any other return on this investment. The upfront investment cost of the stations would also continue to generate savings in compliance costs in the future.

Of course, Delta would get the same benefit if Exxon or any other entity installed the additional 500 E85 stations so it is not clear why Delta would actually make the full investment. However, every other oil refinery would face the same incentive as Delta, so all would have a strong incentive to increase E85 sales to reduce compliance costs.[13] As shown in Figure 5, RIN prices could be reduced to less than one cent if 1,500 new E85 stations were strategically installed. This number of stations would reduce compliance costs to Delta and all other refineries to near zero in 2014. This example demonstrates that a decision by EPA to adopt a 14.4 billion gallon ethanol mandate in 2014 would create a strong incentive to invest in new E85 stations to simply reduce 2014 compliance costs.

The incentive to install new E85 stations would be even stronger if EPA were to announce mandates of 14.4 billion gallons in 2014 and 15 billion gallons in 2015. Even though it is technically feasible to meet a 14.4 billion gallon mandate in 2014 with no new investment, the cost of meeting the mandate would fall dramatically by investing in 1,500 stations. Figure 5 shows that a total of at least 3,000 stations would be needed in 2015 to make it feasible to meet the 15 billion gallon mandate. It would be much easier for oil refineries to justify the first 1,500 stations to lower their compliance costs if they know that they will need 1,500 more stations in 2015.

Figure 5 shows that there are initially large, but sharply diminishing, reductions in RIN prices from investing in new E85 stations. Given these diminishing returns to investing in E85 stations, a 15 billion gallon mandate for 2015 and beyond would likely induce enough investment to lower RIN prices to about 20 cents per gallon, which would require about 5,000 new E85 stations. If cellulosic ethanol production ramps up in 2016 and beyond, additional incentives to install new stations to facilitate consumption of more ethanol would likely materialize.

The analysis presented here is limited to consideration of feasible compliance paths using E85 to increase ethanol consumption. Compliance could also be achieved using E15, which has been approved by EPA for model year 2001 and later light duty vehicles. High RIN prices also create an incentive to install E15 pumps in existing stations. The exact combination of E85 and E15 that would be used for compliance would depend on which minimizes compliance costs. The cost of installing E15 sales capability in a station is lower than installing E85 capability, but E85 contains far more ethanol than E15 so fewer E85 pumps would need to be installed.

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[11] It would actually be a tank and pump that would be installed at an existing station that would allow E85 to be sold.

[12] US Environmental Protection Agency, Assessment and Standards Division, Office of Transportation and Air Quality. 2010. "Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis." EPA-420-R-10-006.

[13] Oil refineries have an even stronger incentive to lobby against the need to sell E85 by convincing the EPA to lower mandates to below E10 blendwall levels.

Policy Implications

Our results show that increasing consumption of ethanol beyond E10 levels can be accomplished either by reducing the price of E85 or by increasing the number of stations that sell the fuel. For any given consumption target there is an inverse relationship between how much the price of E85 must be reduced and the number of stations that sell the fuel. The RIN trading system that EPA uses to enforce biofuel mandates is the mechanism that would facilitate the required price reductions in E85. The greater the reduction in E85 price that is required to induce consumers to use the fuel, the greater the RIN price. Higher RIN prices imply higher compliance costs for owners of oil refineries. Thus, high RIN prices create an incentive for these owners to lower their compliance costs by increasing the number of stations that sell E85. An increase in the number of E85 stations would increase the demand for E85, increase the price of E85, lower RIN prices, and thus lower compliance costs.

The key point is that creation of sufficient demand to meet ethanol blending targets that exceed E10 levels is contingent on EPA setting mandates sufficiently high to incentivize the investments in fueling infrastructure that allow the targets to be met. The more ambitious the blending target, the higher compliance costs will be, and the greater the incentive to invest in fueling infrastructure that will lower compliance costs and facilitate meeting the ambitious target.

EPA's proposed rule would reduce mandated volumes of biofuel in part because of "supply concerns associated with the blendwall."[14] As demonstrated here the important supply concern associated with the E10 blendwall pertains to the supply of stations that sell E85, not the supply of the biofuel. The lack of stations that sell the fuel results in a lack of demand for ethanol, not a lack of supply. EPA's justification for reducing ethanol mandates means that mandates will not be increased beyond E10 levels until the number of stations that sell E85 increase sufficiently. Our results demonstrate that the number of stations that sell E85 will not increase until EPA sets ethanol mandates beyond E10 levels. If increased mandates need to wait for the stations to be built, mandates will never increase.

One way out of this policy dilemma is suggested by our result showing that 800 million gallons of ethanol can be consumed as E85 in 2014 even with no additional investment in stations that sell the fuel. Combining this additional consumption of ethanol in E85 with consumption of ethanol in E10 and with available banked RINs would facilitate meeting a 14.4 billion gallon mandate in 2014. This level of mandate would be equal to what was expected for 2014, not accounting for any volumes of cellulosic or other advanced ethanol. Adopting a 14.4 billion gallon ethanol mandate would send a clear signal that EPA is not locked into keeping ethanol mandates below E10 levels. It would also increase RIN prices enough to incentivize investments in new E85 stations, which would give EPA the freedom to move the ethanol mandate to 15 billion gallons in 2015. Our results show that it will take at least 3,000 additional stations selling E85 to achieve a 15 billion gallon mandate without use of carryover RINs. If all these stations needed an additional tank for E85, then this involve a one-time investment cost approximately $390 million, or about 20 cents for each gallon of ethanol sold in E85.

The implications for agriculture and the biofuel industry of adopting EPA's proposed rule are potentially far reaching because ethanol consumption growth would be halted.

[14] P. 71737 Federal Register Vol. 79 No. 230/Friday, November 29, 2013, Proposed Rules.

Any growth in the domestic consumption of ethanol from cellulosic materials will come only with a reduction in the consumption of ethanol from corn. Opponents of corn ethanol will certainly applaud this implication. However, the RFS originally envisioned that growth in consumption of cellulosic ethanol would be on top of a fixed level of consumption of corn ethanol. The EPA proposed rule means that cellulosic ethanol producers will compete with corn ethanol producers for a fixed ethanol market rather than an expanding market. This is a fundamental change in how the RFS was originally intended to work, and would change the political dynamic of how different ethanol groups work together moving forward. Certainly this change in policy, if accompanied by a recommitment to future support of cellulosic biofuels, boosts the prospects for producers of drop-in biofuels. However, it would be difficult to interpret EPA's proposed fundamental shift in policy as anything except a reduction in overall support for biofuels, however nuanced one might want to interpret the intent of the proposed rule.

RENEWABLE FUELS ASSOCIATION

ATTACHMENT 2

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The Economic Role of RIN Prices

by Bruce A. Babcock and Sebastien Pouliot

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The Economic Role of RIN Prices

By Bruce Babcock and Sebastien Pouliot

The Environmental Protection Agency created a tradable commodity called RINs (Renewable Identification Numbers)—serial numbers that allow tracking batches of biofuels—to enforce biofuel mandates. To prove they have met their annual biofuel obligations under the Renewable Fuels Standard gasoline and diesel producers and importers accumulate RINs, by either buying biofuels with attached RINs or by buying detached RINs offered in the RIN market. RINs become detached when biofuels are blended with diesel or gasoline. Blenders who are not obligated parties have no use for their RINs; thus they are willing sellers in the RIN market. The price at which RINs are bought and sold is measured in cents per gallon of ethanol. In 2013, RIN prices have varied dramatically, from less than 10 cents per gallon in January to over 140 cents per gallon in July. As of late October, RIN prices for corn ethanol are about 25 cents per gallon.

The surge in RIN prices early in 2013, along with the high July prices and the overall large amount of price variability, have led some to conclude that there must be something wrong with either the RIN market or the Renewable Fuels Standard. US senators have asked the Commodities Futures Trading Commission to investigate market manipulation, and obligated parties have called for repeal of biofuels mandates, because they feel the high cost of acquiring RINs shows that biofuel blending targets are unattainable. To determine whether or not there is any basis for these conclusions requires an understanding of the economic role that RIN prices play in ensuring that biofuel blending targets are met.

Principles of economic classes teach that in competitive markets, prices settle where the quantity of a product that sellers want to sell equals the quantity that buyers want to buy. Thus, market prices reflect both the value that buyers place on the product as well as the production costs. If demand increases, then the resulting price increase signals producers to expand production. If production costs decrease, then the price of the product falls to reflect lower production costs.

Demand for RINs exists solely because they are needed to meet EPA requirements. In a hypothetical market with no biofuel mandate there would be no demand for RINs so the price of RINs is zero. RIN prices are positive only when the number of RINs that obligated parties need exceeds the number that would be supplied absent the mandates.

When biofuels consumption is increased by mandates, the cost of producing the extra quantity of biofuels exceeds the value of the additional consumption. However, biofuels plants will not produce the additional quantity unless the price they receive covers their increased production costs. Blenders and consumers will not consume the extra quantity of biofuels produced unless the price they pay drops enough to make it an attractive purchase. Something must close this gap between the cost of production and the value of consumption, and this is the role that RIN prices play in the market. Thus, the difference between the cost of producing additional biofuels and the value that the additional biofuels bring in the market determines RIN prices.

The low ethanol RIN prices that prevailed until January 2013 signaled that ethanol mandates did not force more consumption than was desired by buyers. The demand for ethanol was boosted by tax credits until December 2011, which partly explains why consumption levels exceeded mandates. However, obligated parties realized in January 2013 that the scheduled increases in mandated ethanol consumption in 2014 and beyond could not be easily met because consumption of ethanol in 10 percent blends was limited to about 13 billion gallons and ethanol mandates were scheduled to force consumption to 15 billion gallons in 2015. Thus, for the first time, it looked like the demand for RINs was going to exceed the supply of RINs, and not surprisingly, the price of RINs increased dramatically. What is surprising about the surge in RIN prices is not that it happened, but that it did not happen earlier.

RIN prices reflect the cost of complying with the Renewable Fuels Standard—when RIN prices are high, so too are the costs of compliance. Just as high crude oil prices increase the incentive to explore for more oil and find substitutes for gasoline, high RIN prices create an incentive to find lower-cost alternatives of meeting mandates. Costs can be lowered either by decreasing biofuel production costs or by increasing the value of biofuels in the market place.

The market for ethanol in the United States is limited by the number of stations that sell higher-than-10-percent ethanol blends. E15 and E85 are two fuel blends that can be sold in the United States containing up to 15 and 85 percent ethanol, respectively; however, sales of both are limited by a lack of pumps and tanks capable of handling the fuels at retail gasoline stations. We recently estimated that a maximum of about 14 billion gallons of ethanol could be consumed in the United States with the current infrastructure, but only if the price of E85 is low enough.[1] We also estimated that about one billion gallons of additional ethanol could be consumed for each additional 2,500 stations equipped to sell E85. What this means is that without an incentive to invest in infrastructure, ethanol consumption will always be limited to 14 billion gallons.

EPA is currently determining biofuel mandate levels for 2014. Suppose EPA decides on a mandate that requires consumption of 14 billion gallons of ethanol. RIN prices would then increase dramatically because the incremental value of ethanol to blenders and consumers is close to zero at 14 billion gallons with current infrastructure. Because high RIN prices imply high compliance costs, this mandate would create a large incentive to lower compliance costs. The most effective way to reduce compliance costs would be to invest in E85 infrastructure. Babcock shows that by investing no more than $325 million,

[1]Babcock, B.A., and S. Pouliot. 2013. "Price It and They Will Buy: How E85 Can Break the Blend Wall." Policy Brief (13-PB-11), Center for Agriculture and Rural Development, Iowa State University. Babcock, B.A., and S. Pouliot. 2013. "Impact of Sales Constraints and Entry on E85 Demand." Policy Brief (13-PB-12), Center for Agriculture and Rural Development, Iowa State University.

compliance costs would be reduced by about $1.75 billion.[2] Clearly, if EPA sets the mandate at difficult-to-achieve levels, the resulting increase in RIN prices will signal a large incentive to invest in the infrastructure that turns difficult-to-achieve mandates into easy-to-achieve mandates.

Press reports indicate that EPA may reduce 2014 ethanol mandates to levels that can be easily met with 10 percent blends. Ethanol RIN prices should fall to zero if EPA ultimately decides on this course. Because zero RIN prices imply zero compliance costs, there will be no incentive to avoid compliance costs by increasing investment in retail infrastructure. If EPA justifies such an easy-to-achieve mandate level by a need to avoid high RIN prices, then mandates will need to stay low because RIN prices will only stay low if mandates are easy to achieve. The only way out of this circle is if some outside group decides to invest in E85 infrastructure, thereby allowing EPA to expand mandates while keeping RIN prices low.

Rather than being a sign that something was wrong with RIN markets or the RFS, the surge in RIN prices in 2013 did what RIN prices are supposed to do: they signaled that mandates in 2014 and 2015 were going to be costly to achieve. The cure for high compliance costs is investment in E85 and E15 infrastructures, which, in turn, would allow for the higher future biofuel consumption levels that are envisioned in current policy.

[2] Babcock, B.A. 2013. "RFS Compliance Costs and Incentives to Invest in Ethanol Infrastructure." Policy Brief (13-PB-13), Center for Agriculture and Rural Development, Iowa State University.

RENEWABLE FUELS ASSOCIATION

ATTACHMENT 3

E15 and Infrastructure

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Produced under direction of Renewable Fuels Association by the National Renewable Energy Laboratory (NREL) under Technical Services Agreement No. TSA 14-665 and Task No. WTJZ.1000.

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Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

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Strategic Partnership Project Report
NREL/TP-5400-64156
May 2015

Contract No. DE-AC36-08GO28308

NATIONAL RENEWABLE ENERGY LABORATORY

E15 and Infrastructure

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List of Acronyms

AHJ	authority having jurisdiction
CARB	California Air Resources Board
CFR	Code of Federal Regulations
E0	pure gasoline
E10	10% denatured ethanol; 90% gasoline blendstock
E100	pure ethanol fuel
E15	15% denatured ethanol, 85% gasoline blendstock
E25	25% denatured ethanol, 75% gasoline blendstock
E85	marketing term for high-blend ethanol 51%–83%
EPA	U.S. Environmental Protection Agency
FDEQ	Florida Department of Environmental Quality
NACS	National Association of Convenience Store Owners
NREL	National Renewable Energy Laboratory
OSHA	Occupational Safety and Health Administration
OUST	Office of Underground Storage Tanks
PEI	Petroleum Equipment Institute
psi	pounds per square inch
RFA	Renewable Fuels Association
STI	Steel Tank Institute
STP	submersible turbine pump
UL	Underwriters Laboratories
ULSD	ultra-low sulfur diesel
UST	underground storage tank
vol%	percent by volume

Executive Summary

This paper addresses the compatibility of E15 (15% denatured ethanol, 85% gasoline blendstock) with equipment at refueling stations. Over the last decade, a tremendous amount of work by refueling equipment manufacturers, industry groups, and federal agencies has resulted in a long list of equipment that can be used with E15. This report addresses compatibility through a literature review, a summary of applicable codes and standards, review of equipment manufacturer products, and verification with manufacturers regarding which ethanol blends work with their products. Over time, the refueling equipment manufacturers have improved their sealing materials for compatibility with a wide range of fuels. Upgrading materials in equipment improves consumer safety and reduces the risk of releases to the environment.

It is often stated that tanks cannot be used to store E15, but this assumption is incorrect as the majority of installed tanks can store blends above E10. For many decades, underground storage tank (UST) manufacturers approved their tanks for blends up to E100, for example, all steel tanks and double-walled fiberglass tanks since the year 1990. Manufacturers of pipe thread sealants (pipe dope) used in UST systems have stated that their products have been compatible with ethanol blends up to E20 for many years. For those tanks with low ethanol blend certifications, the U.S. Environmental Protection Agency's (EPA's) Office of Underground Storage Tanks (OUST) issued *Guidance – Compatibility of UST Systems with Biofuels Blends* in 2011 to enable alternative compliance with federal code as UST systems are in use for decades. This guidance allowed tank manufacturers to issue letters stating the compatibility of their tanks with specific ethanol blends. All existing tank manufacturers have issued such letters, and the majority of installed tanks are compatible with E15. Additionally, all existing pipe manufacturers have Underwriters Laboratories (UL) listing for E100.

All fuel and vapor handling equipment at a station was reviewed to determine if it was certified by a third-party (such as UL) and if it was listed for specific ethanol blends. The aggregated list confirms there are UL testing standards available now for all gasoline–ethanol blends from 0% to 85% ethanol. Stations comprise approximately 60 pieces of equipment designed to move and control fuel and vapors. The function of most equipment is to prevent, detect, and contain releases. The equipment includes tanks; pipes; dispensers and associated hanging hardware (breakaway, hose, nozzle, and swivel); fill equipment; leak detection; overfill prevention; and vapor equipment. Some of this equipment is specifically covered by codes and standards while other equipment relies on sound design and manufacturing. Certain equipment types are typically UL listed—these include tanks, pipes, dispenser, hanging hardware, submersible turbine pumps, and shear valves. UL listing is not a requirement; some manufacturers simply prefer to have UL listings for their products. Manufacturers will select, which, if any, models they will list for ethanol blends above E10. A review was conducted with each manufacturer to determine compatibility with ethanol blends. There is an extensive list of E15 and E15+ compatible equipment available in the appendices.

A literature review going back 15 years was conducted to determine if there were any negative impacts during the multi-year deployment of E10 nationwide. No incidents of E10 causing releases (also referred to as leaks) from UST systems were identified. None of the reviewed literature noted any association between E10 and any specific UST release. The EPA OUST's Performance Measures' data on UST releases were reviewed, and as E10 was deployed

nationwide, the trend was fewer UST releases. Anecdotal input solicited from infrastructure industry experts said that they knew of no published reports of releases caused by E10.

There are future opportunities for retailers to remove or replace their current equipment not necessarily related to continuous changes in motor fuel composition. Credit card companies are requiring retail fueling stations to update their dispensers to accept new chip and PIN secure credit cards by October 2017, at which time fraud liability would switch to station owners if they have not updated their equipment. This presents an opportunity to increase E25 UL-listed equipment through a retrofit kit if electronics are being upgraded to accommodate the new credit cards, or if a station owner must purchase a new dispenser, it could pay a minimal amount more for an E25 dispenser. If a new dispenser is purchased, this may also present an opportunity to upgrade to an E85 dispenser, but at significant additional cost.

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1 Background

1.1 E15 Background

In 2011, the U.S. Environmental Protection Agency (EPA) approved E15 for use in conventional light-duty cars and trucks model year 2001 and newer.[1] As of the end of 2014, 65% of the registered gasoline vehicles are 2001 and newer.[2] EPA approved the Clean Air Act waiver based on significant testing and research (McCormick et al. 2013). EPA defines E15 as ethanol blends greater than 10 volume percent (vol%) and up to 15 vol% ethanol. E15 is not widely available largely due to misinformation and retailer concerns. The primary concerns retailers have expressed include additional federal and state regulations to sell E15, misfueling liability, and the inability to meet the EPA's vapor pressure requirement for E15 in the summer.

Regulations to sell E15: There are several federal government requirements for selling E15 that do not apply to other fuel sold at stations. Federal regulations for a station to sell E15 include: an EPA E15 label on each dispenser selling E15, implementation of a misfueling mitigation plan,[3] participation in a fuel quality survey (ensures dispenser is labeled and measures ethanol content and vapor pressure), product transfer documents for all deliveries of fuel for E15 use, and an approved dispenser/hose configuration.[4] All requirements for E15 are available in the Renewable Fuels Association's (RFA's) *E15 Retailer Handbook.*[5]

Exposure to liability: Some stations owners have expressed concerns about misfueling of E15 into older vehicles. It is not uncommon for a consumer to be unaware of the model year of their vehicle. Under the Clean Air Act, any entity in the transportation fuel supply chain, including refueling stations, could be fined by the EPA up to $37,500 per day for violations. The EPA has never fined a station this amount, and it has the authority under code to reduce the fine based on business size.

Vapor pressure: Blending of ethanol in to gasoline in the 10 to 15 vol% range typically causes the vapor pressure to increase by 1 pound per square inch (psi).[6] The EPA regulates gasoline vapor pressure from June 1 to September 15 to reduce evaporative fuel emissions. In 1992, E10 received a 1-psi waiver, commonly known as the 1-pound waiver, from these requirements for non-reformulated gasoline areas. For purposes of the 1-pound waiver, E10 blends are defined as containing 9 to 10 vol% ethanol. The E10 1-pound waiver code is included in the Code of Federal Regulations which states that the waiver is for E10 only and not any other ethanol blend.

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[1] E15 Notices & Regulations. EPA. http://www.epa.gov/otaq/regs/fuels/additive/e15/e15-regs.htm
[2] Polk data 2014. Based on a total U.S. gasoline light-duty vehicle registration of 228 million of which 149 million are model year 2001 and newer.
[3] RFA developed *Renewable Fuels Association Model E15 Misfueling Mitigation Plan*, which was approved by EPA in March 2012 and is available free of cost to stations selling E15. http://www.epa.gov/otaq/regs/fuels/additive/e15/documents/rfa-model-e15-misfueling-mitigation-plan.pdf
[4] For hose configurations, please review the EPA-approved *Addendum: E15 Retail Advisory (updated 1/2013)*. Last accessed March 10, 2015: http://www.epa.gov/otaq/regs/fuels/additive/e15/documents/rfa-e15-retail-advisory-addendum.pdf
[5] *E15 Retailer Handbook*. RFA. Accessed March 10, 2015: http://ethanolrfa.3cdn.net/643f311e9180a7b1a8_wwm6iuulj.pdf
[6] Vapor pressure is a method to measure the volatility of gasoline. Formerly known as Reid vapor pressure or RVP, today it is technically dry vapor pressure equivalent (DVPE) and is measured using ASTM Method D5191.

E15 is not afforded the same 1-pound waiver and therefore cannot be sold in non-reformulated gasoline areas in summer months unless a lower vapor pressure hydrocarbon blendstock is used.[7]

1.2 Station Data

Overall, the total number of retail stations has declined over time, but approximately 1,600 new stations open annually (AFDC 2015, NACS 2014a). The following statistics from the National Association of Convenience Store Owners (NACS) *2015 Retail Fuels Report* show some of the challenges in reaching various types of station owner and their ability to afford equipment upgrades and installations (NACS 2015):

- There are approximately 153,000 fueling stations.
- Fifty-eight percent are single-store owners/operators.
- Major oil companies own 0.4% of stations.
- Approximately 50% of stations sell branded fuel.
- Convenience stores sell 80% of transportation fuels. Hypermarkets (large grocery chains or merchandise stores) sell 14%. The remainder of fuel is sold at low-volume locations like marinas.
- Sales per convenience store average 128,000 gallons per month (4,000 gallons/day).
- Transportation fuels are 71% of sales at a convenience store, but only 36% of profits.
- The average profit per convenience stores in 2013 was $55,000 with most profit coming from selling products in the store.

One of the challenges in introducing E15 is reaching all the single-station owners. As evidenced in Figure 1, after single-store owners, the next highest percentage of ownership—17%—is ownership groups with more than 500 stations.

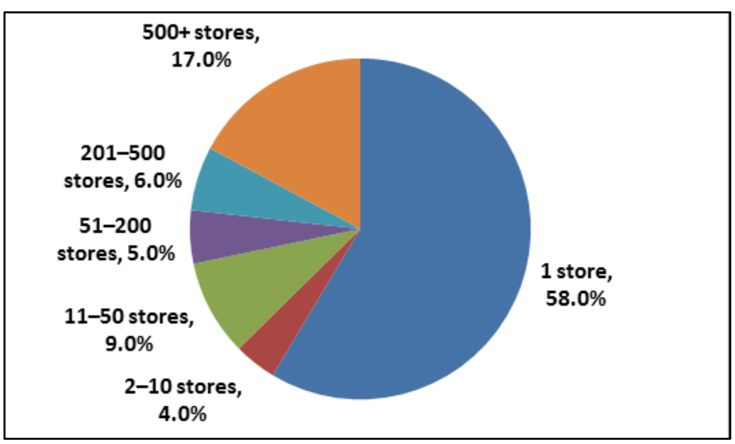


Figure 1. Breakout of station ownership

Source: *2015 Retail Fuels Report.* NACS, 2015

[7] CFR 42 Chapter 85 Subchapter II Part A 7545 Regulation of Fuels (h) (4)

Approximately 50% of convenience stores are branded by either an oil company (31%) or refinery/distributor (19%) (NACS 2014b). This ensures a market for oil and refinery company products and provides station owners with brand recognition. A contract typically lasts 10 years, and the terms will include sales volume requirements for fuels supplied, including regular and premium, and diesel if the station sells it. Due to sales volume requirements, there will be more challenges for branded stations to sell E15 than independent stations or convenience store chains.

2 Regulations, Codes, and Certifications

In addition to the EPA requirements summarized in Section 1.1, E15 is subject to other regulations and codes that apply to other transportation fuels. There is no one entity that regulates all equipment at a station. Often times, the local authority having jurisdiction (AHJ) approves a station to sell a new fuel. "AHJ" refers to regulating organizations, offices, or individuals responsible for overseeing codes and standards and ensuring safety. Examples of AHJs include local fire marshals, state energy and environment offices, air and water boards, and similar organizations or offices. The most significant federal agencies overseeing some equipment at stations include EPA's Office of Underground Storage Tanks (OUST) and the Occupational Safety and Health Administration (OSHA). The Underwriters Laboratories (UL) role is significant in developing testing protocols and certifying refueling equipment for specific fuels.

Two organizations, the National Fire Protection Association (in particular, Code 30A, which includes language on alternative compliance to address new fuels) and the International Code Council, provide standard codes for retail stations that are accepted or modified to meet local requirements. Other organizations developing best practices and codes include American Petroleum Institute, Fiberglass Tank and Pipe Institute, NACE International, National Conference on Weights and Measure, National Leak Prevention Association, Petroleum Equipment Institute (PEI), and Steel Tank Institute (STI).

2.1 EPA Office of Underground Storage Tanks

EPA's OUST regulates tanks that store transportation fuels under Subtitle I of the Solid Waste Disposal Act states that a tank system must be compatible with the fuel stored. This code is currently under revision with a final rule expected in 2015. States administer the underground storage tank (UST) program, and compatibility is the responsibility of the tank owner.

The following critical components must be demonstrated as in compliance with federal code: tank (including tank lining); piping; line leak detector; flexible connectors; drop tube; spill/overflow equipment; submersible turbine pumps (STPs); sealants (pipe dope, thread sealant, fittings, gaskets, O-rings, bushings, couplings, boots); containment sumps; release detection floats/ sensors/probes; fill and riser caps; and shear valves.

Title 40 of the Code of Federal Regulations (CFR) Part 280–Technical Standards and Corrective Action for Owners and Operators of Underground Storage Tanks (UST), covers design, construction, and installation; operating requirements; release detection; release reporting; corrective action for releases; UST out-of-service and closures; financial responsibility (ability to cover the costs to clean up a release); and lender liability. It requires that tanks and piping be constructed, installed, and any portion that is underground and routinely contains product be protected from corrosion in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory. It also requires that the UST be made of or lined with materials compatible with the regulated substance stored. There are requirements to have equipment installed to prevent releases, including the use of spill containment and overfill prevention equipment. There are also requirements to have equipment capable of detecting releases of regulated substances from the portions of the UST that routinely contain product. Since 1986, UST owners must submit documentation that a new tank has been installed along with certification of installation and keep maintenance records. UST owners must report all suspected and confirmed releases, generally within seven days.

40 CFR Part 281–Approval of State Underground Storage Tank Programs, and Part 282–Approved Underground Storage Tank Programs, explain the requirements to authorize states to administer UST federal code under Subtitle I of the Resource Conservation and Recovery Act. 40 CFR Part 302 Designation, Reportable Quantities, and Notification, defines hazardous subjects stored in USTs (includes gasoline, ethanol, and many other chemicals), releases, and penalties.

In 2011, OUST released the *Guidance – Compatibility of UST Systems with Biofuels Blends* document, which provides an alternative path for demonstrating compliance with the compatibility requirements in federal code when storing biofuels above E10 or B20 (20% biodiesel; 80% petroleum diesel) (EPA 2011). OUST believes that while most biofuel blends are compatible with tanks and pipes, there could be issues with associated UST equipment.[8] Tanks and associated equipment are in use for decades, and the guidance allows manufacturers to state compatibility with specific biofuel blends. This guidance is expected to be published in the CFR in 2015 after the Office of Management and Budget approves it. Incorporating this guidance into the CFR gives refueling station owners an added layer of security as it ensures their tank insurance is uncompromised, which is also an important factor in their ability to maintain a line of credit with their financial institution.

2.2 Underwriters Laboratories

UL is the primary third-party certification laboratory servicing the refueling equipment industry globally. UL develops testing standards by consensus and allows manufacturers time to comply.[9] These standards have been available for many decades in the marketplace. There are many standards covering individual products in the fueling system and many different approaches to evaluating safety. The more recent standards address higher levels of ethanol and the introduction of biodiesel. Some standards comprehensively evaluate structural integrity, material compatibility, operating performance, and electrical safety while others may limit evaluations to specific items. In the past, some standards that provided listings for specific fuels were limited to petroleum products, but were then revised to handle low levels of ethanol blends. Over time, many UL standards provided the option for equipment manufacturers to list their products for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85). While some UL standards allow manufacturers to select which fuel ratings to list for, there is trend towards revising standards to require equipment to be listed for all fuel types and blends that are commercially available. Testing is not conducted with commercial fuels. The trend is towards aggressive test fluids where gasoline is represented by Reference Fuel C (equal parts iso-octane and toluene) and it is mixed with ethanol, acid, and water. Table 1 summarizes the relevant refueling equipment UL standards. Information on applicable UL standards for each piece of refueling equipment at a station is described in Section 4. Table 1 confirms that there are UL testing standards available now for all gasoline–ethanol blends from 0% to 85% ethanol content.

[8] Communicated by EPA OUST staff during a December 2013 call with National Renewable Energy Laboratory and Oak Ridge National Laboratory staff.
[9] The terms “UL listed” and “UL certified” can be used interchangeably.

Table 1. Key UL Testing Standards for Refueling Equipment

UL Testing Standard	Equipment Covered	Listing for Ethanol Blends
UL 58	Underground steel tanks	Does not list for specific fuels
UL 1316	Underground fiberglass tanks	E100 (non-aggressive test fluids)
UL 971	Pipes and pipe fittings	E100 (non-aggressive test fluids)
UL 2447	*Sumps:* tank, dispenser, transition, fill/vent (spill buckets) *Sump fittings*: penetration, termination, internal, test and monitoring *Sump accessories*: cover, frame, brackets, chase pipe	E85 (non-aggressive test fluids for current listings). The new Standard 2447 requires testing with aggressive E25 and E85. Manufacturers must recertify by June 2016.
UL 2583	*Part I Vapor Control Products:* emergency vents, pressure vacuum vents, fill and vapor adaptors, and monitor well caps *Part II Liquid Control Products:* overfill protection (or prevention) valves, ball float vent valve (or flow restriction device), drop tubes, extractor tee, jack screw kit, face seal adaptor (or threaded riser adaptor), fill cap and adaptors	Part I and Part II require testing with aggressive E25, E85, B25, and Reference Fuel F.
UL 87	Power-operated dispensing devices for petroleum products	E10 (non-aggressive test fluid)
UL 87A	Power-operated dispensing devices for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 25	Meters for flammable and combustible liquids and LP-gas	E10 (non-aggressive test fluid)
UL 25A	Meters for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 79	Power-operated pumps for petroleum dispensing products	E10 (non-aggressive test fluid)
UL 79A	Power-operated pumps for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 330	Hose and hose assemblies for dispensing flammable liquids	E10 (non-aggressive test fluid)
UL 330A	Outline for hose and hose assemblies for use with dispensing devices dispensing gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 331	Strainers for flammable fluids and anhydrous ammonia	E10 (non-aggressive test fluid)

UL Testing Standard	Equipment Covered	Listing for Ethanol Blends
UL 331A	Strainers for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 428	Electrically operated valves	E10 (non-aggressive test fluid)
UL 428A	Outline for electrically operated valves for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 567	Emergency breakaway fittings, swivel connectors and pipe-connection fittings for petroleum products and LP-gas	E10 (non-aggressive test fluid)
UL 567A	Emergency breakaway fittings, swivel connectors and pipe-connection fittings for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 842	Valves for flammable fluids	E10 (non-aggressive test fluid)
UL 842A	Valves for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 - E85)	E25 and/or E85 (tests with aggressive test fluids)
UL 2586	Hose nozzle valves	E10 (non-aggressive test fluid)
UL 2586A	Hose nozzle valves for gasoline and gasoline–ethanol blends with nominal ethanol concentrations up to 85% (E0 – E85)	E25 and/or E85 (tests with aggressive test fluids)

Source: UL

2.2.1 UL Standards Summary

UL 1316, Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures

This standard covers underground fiberglass tanks and allows manufacturers to select in which of three fuel ratings to have their product listed. Essentially it is an "a la carte" menu. Both existing fiberglass tank manufacturers have UL listing for E100.

The test fluids used to evaluate compatibility for the three fuel ratings are:

1. Petroleum products: includes but is not limited to: regular and premium gasoline, diesel fuel, fuel oil, Reference Fuel C, kerosene, and fuel oil #6 (option at elevated temperature)
2. Alcohol and petroleum blends: includes fuel #1 plus E10 and E30. (This allows listing for E10 but not E30 despite testing with it.)
3. Alcohol and petroleum blends: includes #1 and #2 test fluids plus E15, E50, E100, and methanol blends at the same volumes.

UL 58, Standard for Steel Underground Tanks for Flammable and Combustible Liquids

This standard covers underground steel tanks. It does not test or certify equipment for specific fuels but instead for flammable and combustible liquids. All existing U.S. steel tank manufacturers have UL listing under this standard.

UL 1746, External Corrosion Protection Systems for Steel Underground Storage Tanks

This standard provides certification for external corrosion protection systems applied to UL 58 steel tanks. There are four parts, and parts i (galvanic-type cathodic protection systems), ii (fiber-reinforced plastic composite systems), and iv (polyurethane-coated systems) do not test with specific fuels; listing is for flammable and combustible liquids. Part iii (polyurethane, polyurea, high density polyethylene, or fiber-reinforced plastic jacketed systems) provides ethanol listing only for jacket tanks with secondary containment because there is an interstitial space formed by the jacket. The test requires 30 days of exposure to test fluid and includes the same testing fluids as UL 1316.

UL 1856, Underground Fuel Tank Internal Retrofit Systems

This standard allows a station owner to retrofit the existing tank onsite in three ways, all of which require the tank's internal surface to be refurbished prior to applying nonmetallic coatings with new fuel ratings. In the past, this standard allowed manufacturers to select which class of fuels to list for, the same as UL 1316. However, UL 1856 has recently been revised to require compliance with all automotive fluids, including E25 and E85, by June 14, 2017.

UL 142, Aboveground Flammable Liquid Tanks

This standard covers aboveground tanks, which are not very common at commercial fueling stations. It does not test or certify equipment for specific fuels but instead for flammable and combustible liquids. UL Standards 2080 and 2085 also apply to aboveground tanks for fire protection, as they require use of a UL 142 core tank.

UL 971, Standard for Nonmetallic Underground Piping For Flammable Liquids, and UL 971A, Outline of Investigation for Metallic Underground Piping for Flammable Liquids

This standard covers flexible and rigid piping and pipe fittings for both fuel and vapor. This standard has similar fuel ratings and uses similar test fluids as UL 1316. All existing pipe manufacturers have UL listing for E100.

UL 2039, Outline of Investigation for Flexible Connector Piping for Fuels

This standard covers flexible connectors that typically connect underground piping to other equipment in sumps. In the past, this standard offered the same selection of test fluids as UL 1316. The standard was updated in December 2010 to require all automotive fluids, including E25 and E85.

UL 2447, Containment Sumps, Fittings and Accessories for Fuels

This standard covers containment sumps (dispenser, tank, transition, spill buckets) and all the fittings (termination, penetration, test/monitor, internal) and accessories (frames, brackets, chase, etc.). This standard previously and currently allows manufacturers to select test fluids from the same three classes as UL 1316. However, the standard has been updated, and manufacturers will need to demonstrate compliance with the standard and listing for all automotive fuels, including E25 and E85, by June 30 2016 (originally the date was June 30, 2015, but manufacturers asked for an extension). Some manufacturers list under this standard and others do not.

UL 2583, Outline for Investigation for Fuel Tank Accessories

This new standard covers equipment that may have been listed under other, older standards and also covers equipment that has never previously been listed by UL. Few manufacturers listed products under the old standards. This new standard requires manufacturers to list all automotive fuels, including E25 and E85. Part I was issued in June 2011 to cover all vapor control products—any functional device on tank top or directly fitting on or indirectly connected to a pipe to control vapors. Equipment covered includes emergency vents, pressure vacuum vents, fill and vapor adaptors, and monitor well caps. Part II was issued in June 2014 and covers liquid control products; specifically functional equipment designed to connect to tank top and to contain spills and prevent overfills. This covers overfill protection (or prevention) valves, ball float vent valves (or flow restriction devices), drop tubes (never previously listed by UL), extractor tees, jack screw kits, face seal adaptors (or threaded riser adaptors), fill caps, and adaptors.

UL 87, Power-Operated Dispensing Devices for Petroleum Products, and UL 87A, Standard for Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85)

UL 87 allows listing for up to E10 with minimal exposure to test fluids. In 2007, UL introduced UL 87A, Outline of Investigation for Power-Operated Dispensing Devices for Gasoline/Ethanol Blends with Ethanol Content Greater than 15 Percent to address E85. At the time, UL 87A covered additional testing for multiple pieces of related equipment. These standards work somewhat differently than those for tanks, pipes, and associated tank equipment. A manufacturer can select UL 87 for listing a product up to E10 or UL 87A to list a product for up to just E25 or opt to test and list it for E85 also. Since development of UL 87A in November 2012, equipment has been split out into different standards specific to each equipment type. (The designation “A” after a listing denotes the option to list a product for up to just E25 and/or E85).

- Breakaways, swivels, pipe connection fittings: 567/567A
- Dispensers: 87/87A
- Filters: 331/331A
- Hoses: 330/300A
- Meters: 25/25A
- Nozzles: 2586/2586A

- Shear valve (emergency shut-off valve): 842/842A
- Submersible turbine pump: 428/428A

2.3 Occupational Safety and Health Administration

OSHA regulates some fuel-dispensing equipment. Its regulations applicable to service stations have not been updated in decades and therefore do not specifically address biofuels. OSHA is planning to update these standards to address new fuels in the marketplace.

OSHA 1910.106 (g)(3)(iv) and (g)(3)(vi)(a) require dispensers and nozzles to be listed by a third party for specific fuels.

OSHA 1910.106(b)(1)(i)(b) and (c)(2)(ii) require tanks, piping, valves, and fittings other than steel to use sound engineering design for materials used; however, there is no listing requirement. OSHA 1910.106(b)(1)(iii) covers steel tanks and requires sound engineering and compliance with UL 58 and American Petroleum Institute Standards 650 and 12B as applicable.

2.4 State Regulations

2.4.1 California Air Resources Board

The California Air Resources Board (CARB) is the division of the California Environmental Protection Agency tasked with reducing air pollutants. CARB developed test procedures for vapor recovery equipment and requires specialized enhanced vapor recovery equipment. The following equipment must be approved under this program: adaptors, drop tubes, hoses, nozzles, overfill protection devices, pressure vacuum vents, spill containers, and vapor return piping (CARB 2015). The requirements are not for equipment use with specific fuels.

2.4.2 Florida Department of Environmental Quality

The Florida Department of Environmental Quality (FDEQ) approves station storage tank equipment through state regulations (FDEQ 2015). The regulations require State of Florida approval of tank system equipment prior to installation or use, except for the following equipment: dispensers, islands, nozzles, hoses; monitoring well equipment; manhole and fillbox covers; valves; cathodic protection stations; metallic bulk product piping; small-diameter piping not in contact with soil unless the piping extends over or into surface waters; and vent lines. All other equipment must be approved through a third-party laboratory demonstration that provides a technical evalution of the equipment, test results verifying equipment functions as designed, and a professional certification that the equipment meets Florida performance standards (FDEQ 2015). The performance standards are straightforward and are not fuel specific. The State of Florida has a long list of approved equipment (FDEQ 2015).

3 Literature Review

A literature review was performed to identify specific components or materials that have been associated with releases from USTs storing E10. The information is intended to be used to minimize the potential for future releases, particularly during the rollout of E15. The literature review was limited to releases identified during the years 2000 to the present. During the years covered by this literature review, the penetration of E10 into the U.S. gasoline pool went from minimal in many regions of the country to full saturation.

Scope of Review

The following sources were used:

- LUSTLine 2000 – present.
- *PEI Journal* 2009 – present (PEI Journal not available online before 2009).
- *TulsaLetter* (The *TulsaLetter* is the official e-newletter of PEI.) 2000 – present.
- Experts in refueling infrastructure were contacted, including EPA, Fiberglass Tank and Pipe Institute, PEI, STI, and oil industry representatives.
- EPA OUST release data website.
- Web search for literature and data on UST E10 releases.

Major Findings

- The number of reported UST releases has been steadily declining since 2000 from occurring in about 2% of all USTs in the United States to about 1% in 2014 (EPA 2015a).
- There is no evidence of different trends in the number of UST releases between states that were early adopters of E10 and states that only recently reached full saturation of E10.
- EPA has collected data on the source and cause of UST releases. Because of the high number of releases that were attributed to "unknown" or "other causes," the data cannot be considered conclusive, but roughly 10% of all releases were attributed to corrosion in a 2004 review and 7% in 2009 (EPA 2004, Eigmey 2011).
- Anecdotal input solicited from infrastructure industry experts said that they knew of no published reports of releases caused by E10.
- None of the reviewed literature listed any association between E10 and any specific UST release.

Figure 2 shows the number of USTs declining over time which is a result of the declining number of retail stations. There were approximately 571,000 registered USTs in the United States as of September 2014 (EPA 2015a).[10] OUST provides UST release data annually, and over the time that E10 spread across the country, the number of releases has tended to decline from 2% of registered tanks in 2000 to 1.2% of USTs experiencing a release in 2014. Figure 3

[10] A year is measured by the federal government's fiscal year from October 1 to September 30.

shows that as E10 was deployed over the last several years, the number of UST releases did not increase. Any problems associated with introducing a different fuel at an existing station usually happen soon after storing a different fuel. In interpreting these results, it should be noted that many releases are discovered and reported years after they first occurred when the tank is removed from service. Other releases are due to operator errors (such as overfilling or poor maintenance) and may be completely unrelated to the fuel stored.

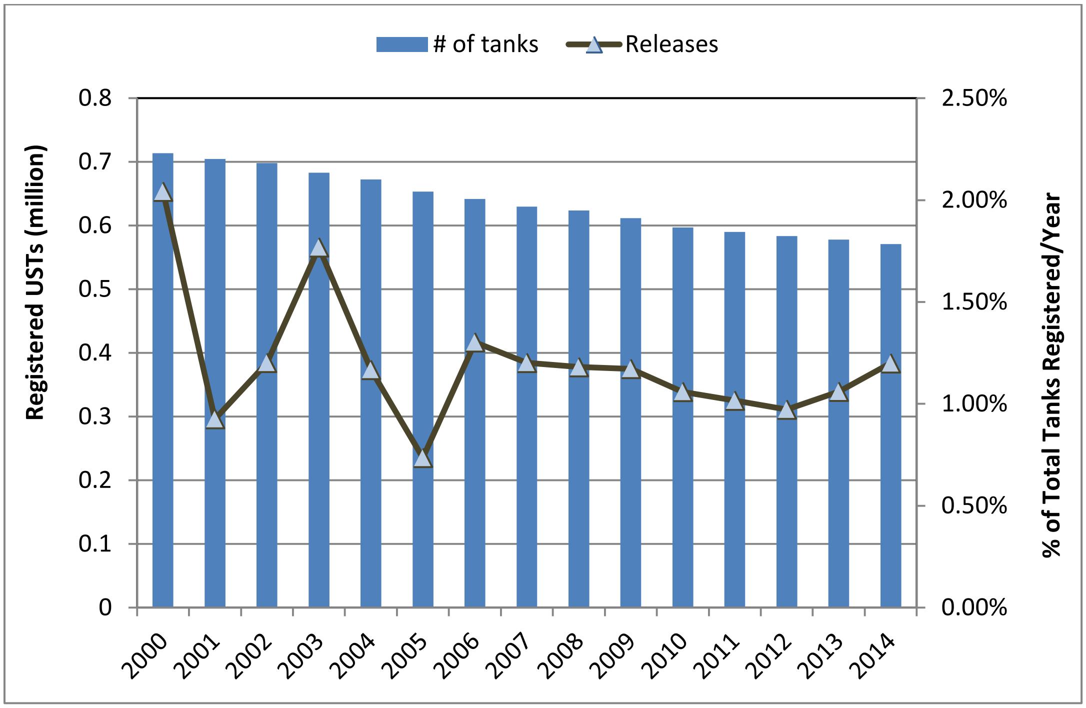


Figure 2. Registered USTs and releases

Source: UST Performance Measures. EPA OUST. Last accessed March 10, 2015: http://www.epa.gov/oust/cat/camarchv.htm

The Energy Policy Act of 2005 included a requirement for UST release reports to include a source and cause. A LUSTLine report analyzed 2009 data reports from 47 states reviewing 5,168 UST releases (Eighmey 2011). While the data point to some areas where leaks are common and uncommon, approximately one-third of leaks were listed as other or unknown. Some releases occur no matter what fuel is being delivered or stored. These releases include physical/ mechanical damage (14.9%), overfills (4.8%), spills (3.8%), and installation problems (1.0%). Transportation fuels can cause corrosion, and this study found corrosion caused 7.5% of releases. The topic of STP corrosion comes up as an issue, but a small scoping study performed for RFA found that STPs were not failing. This 2009 report shows the STP as the source of a release in just one of 5,168 incidents. The EPA reviewed 608 UST releases in 2004 and found causes of release were physical/mechanical (39.8%), other/unknown (27.0%), spill/overfill (26.6%), and installation (3.1%) (EPA 2004). Table 2 summarizes 2009 data for cause and source with detailed data available in Appendix A.

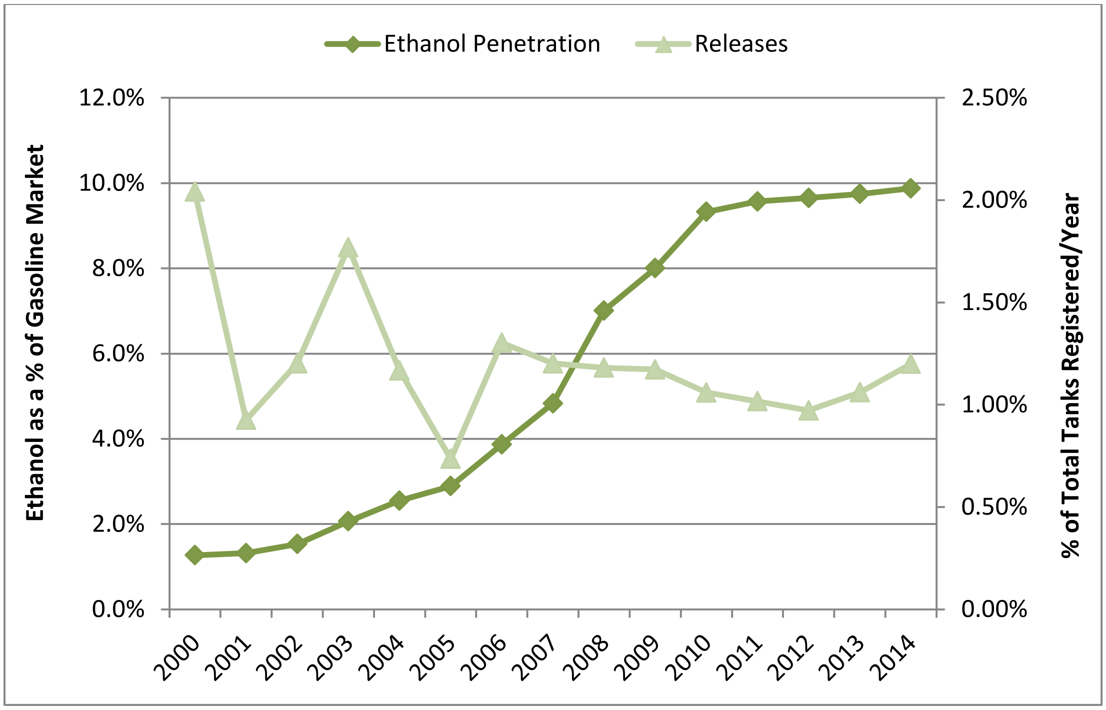


Figure 3. Ethanol penetration and UST releases

Source: Energy Information Agency U.S. Product Supplied of Finished Motor Gasoline: http://www.eia.gov/tools/faqs/faq.cfm?id=23&t=10 and Monthly Energy Review Table 10.3 Fuel Ethanol Overview: http://www.eia.gov/totalenergy/data/monthly/

Table 2. Sources and Causes of UST Releases

UST Releases	**2009 Data (5,168 releases)**	
Source	**#**	**%**
Tank	1,616	31.3%
Piping	720	13.9%
Dispenser	655	12.7%
STP	76	1.5%
Delivery Problem	342	6.6%
Other	564	10.9%
Unknown	1,195	23.1%
Physical/Mechanical Damage	770	14.9%
Spill or Overfill	441	8.5%
Corrosion	385	7.4%
Installation	54	1.0%
Other	466	9.0%
Unknown	3,051	59.0%

Source: Eighmey, C., March 2011, LUSTLine Bulletin #67. Accessed March 10, 2015: http://www.neiwpcc.org/lustline/lustline_pdf/lustline_67.pdf .

As of January 2003, FDEQ requires County Tanks Program inspectors to submit a leak autopsy form. A 2007 study reviewed Florida leak data and found the sources were spill buckets (48%), piping (14%), dispensers (12%), and tanks (10%) (Mott-Smith 2007). The causes were unknown (36%), overfill (25%), mechanical (16%), material (10%), and corrosion (7%). Spill buckets are designed to reduce leaks during fuel delivery. At the time of the report, Florida's E10 penetration was only 5%, so these results do not reflect E10 storage releases but do highlight the importance of maintenance and appropriate fill techniques.

The literature review was directed specifically at identifying ethanol sensitive equipment and included conversations with several leading infrastructure experts to determine if there was evidence and/or literature showing issues with E10 in USTs. Experts suggested that the long, slow introduction of E10 allowed time for refueling equipment manufacturers to adjust to it. None of the experts was aware of any reports and thought it would be unlikely to find any reports on E10 releases. There are examples of equipment failing such as Total Containment, Inc. flexible piping, but it was the opinion of experts that poorly made products would have failed with any fuel, and the failures of flexible piping occurred not long after their introduction and prior to the widespread use of E10. This is not to say that there were no issues during the deployment of E10, just that there were no known releases and no reports on this subject. An Oak Ridge National Laboratory study of E15 stated "UST stakeholders generally consider fueling infrastructure materials designed for use with E0 to be adequate for use with E10, and there are no known instances of major leaks or failures directly attributable to ethanol use. It is conceivable that many compatibility issues, including accelerated corrosion, do arise and are corrected onsite and, therefore do not lead to a release." (Kass et al. 2012).

Several experts cited EPA work on STP corrosion, and both EPA and Battelle work on ultra-low sulfur diesel (ULSD) corrosion. The National Renewable Energy Laboratory (NREL) previously reviewed the STP corrosion issue for RFA. STPs draw fuel from the UST and deliver it to pipes connected to an aboveground dispenser. The State of Tennessee and EPA OUST have investigated and presented on premature STP corrosion. The theory on the cause is that temperature differentials between sumps and UST systems in summer months (or in warm and humid climates) may enable vapors to enter the STP sumps. Vapors that may contain ethanol capable of dissolving in water may condense on metallic portions of an STP, which reacts with acetobacter and oxygen to form acetic acid, leading to corrosion. NREL spoke with numerous state UST offices and county-level experts and did not find any evidence that corrosion was leading to failures or early replacement of STPs. Accelerated corrosion of ULSD UST systems has been observed nationwide. These instances of corrosion started to be reported in 2007 when ULSD was first introduced. The cause of corrosion is currently under investigation, and an EPA OUST study on ULSD corrosion is expected in late 2015.

4 Equipment at Station

A service station consists of many interconnected pieces of refueling equipment necessary to deliver fuel to vehicles. There are approximately 60 pieces of equipment at a station designed to handle fuel and vapor. The equipment delivering fuel to a vehicle includes tanks, pipes, submersible turbine pump, dispenser, and hanging hardware. The remainder and majority of equipment are used to prevent, detect, and contain releases and there is equipment for fuel delivery. This category includes overfill protection, leak detection, shear valves, fill and vapor caps and adaptors, containment sumps and all associated fittings and accessories of these equipment types.

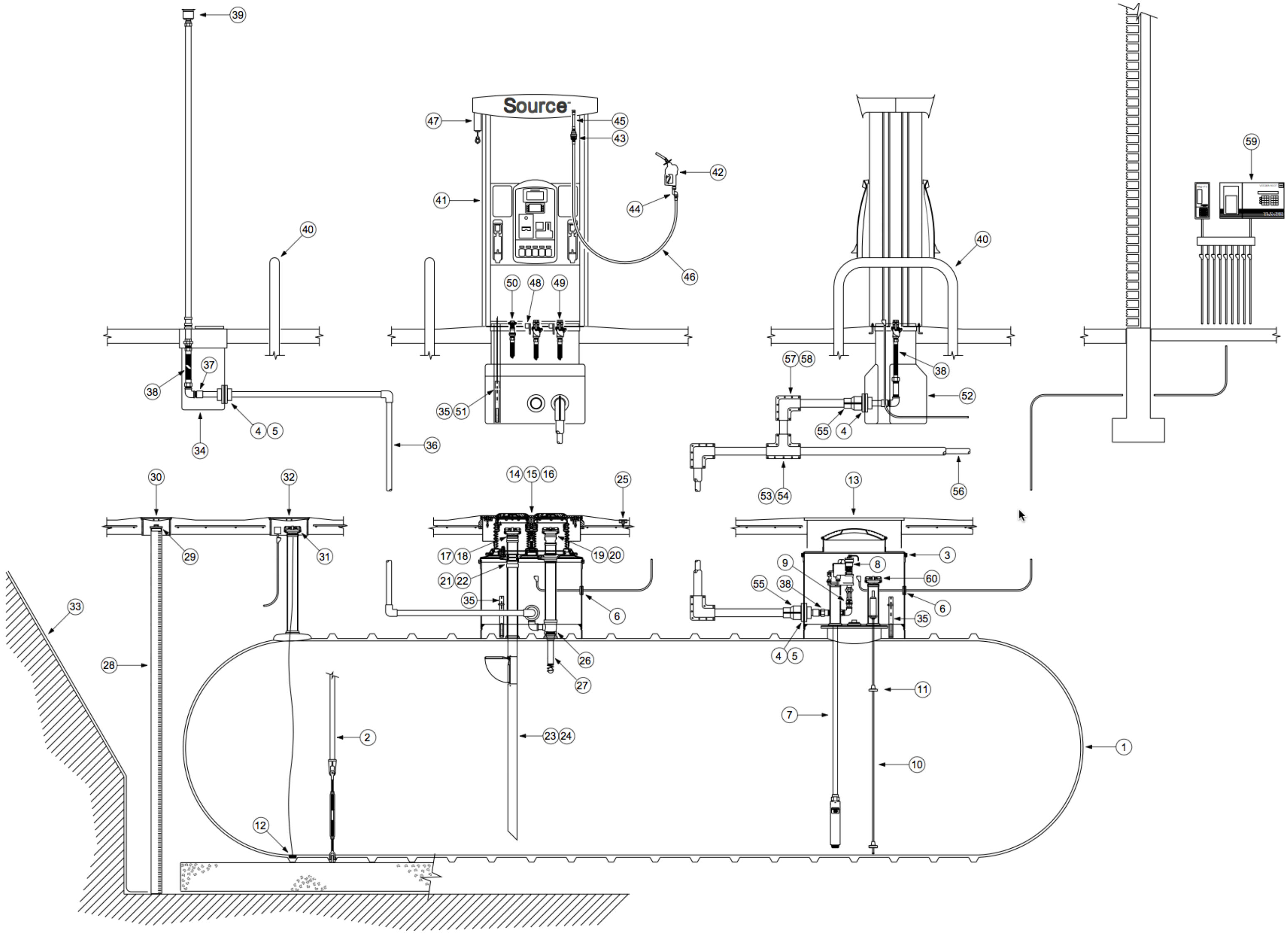
Figure 4 is a diagram of equipment at a station. Table 3 provides a list of the equipment shown in the diagram and includes the purpose of the equipment; common materials; if the equipment is listed by UL, and if it is UL listed, is it tested with fuel or not; if it was tested with fuel; and what the highest level of ethanol listing available under the standard is. Note that #1 in Figure 4 shows just the tank on the diagram, but the table includes information about steel, fiberglass, and aboveground storage tanks and their protections. This list is comprehensive, and not all stations will have equipment on this list. The table data were taken from the following sources: equipment list and diagram (Source North America); UL; equipment materials (manufacturer product websites and catalogs); and function (PEI Wiki and manufacturer product websites and catalogs).

All known manufacturer website product pages and catalogs were reviewed for every equipment type and model to determine if the products could be used with blends above E10. All known manufacturers were contacted to review compatibility lists. This resulted in an extensive list of equipment compatible with blends above E10. Appendix B provides an equipment list of UL-listed aboveground components for blends above E10. Appendix C provides a compatibility list of tanks. Appendix D is a list of compatible pipes. Appendix E provides information for other UST equipment with manufacturer, equipment type, model names/numbers, ethanol compatibility (%), if it is UL listed, and if it is listed for the ethanol fuel determined by the manufacturer. It is important to note that manufacturers typically keep product names over time but may change product model numbers. Also, manufacturers will introduce new product names, and there is a higher likelihood that these products will be compatible with E15.

Determination of compatibility of equipment with ethanol blends is determined by both regulations and manufacturer statements. Manufacturers have laboratories where they conduct fuels testing to determine if the materials they are using work with a range of fuels. Tanks are subject to EPA OUST regulations, and all existing tank manufacturers provided letters stating compatibility with ethanol blends (see Appendix A). Tanks, pipes, and most aboveground equipment are typically UL listed for specific fuels. This includes dispensers, breakaways, hoses, nozzles, swivels, shear valves, and STPs.

Some manufacturers of other UST equipment make an effort to obtain UL listing for all their products, some obtain it for certain products, and others do not obtain UL listing for their products. Many products are approved by the manufacturer for blends above E10 but are not UL listed for blends above E10. This is largely due to the recent availability of ethanol test fluids under UL testing standards, and over time it is expected that more equipment will be UL listed for blends above E10. In many instances, there is not a history of many manufacturers obtaining UL listing for certain product types such as fill equipment or containment sumps.

There is no regulation that requires station owners to keep records of their equipment, making determination of compatibility challenging for stations without equipment records. One potential source of tank information is the STI, which maintains a list of steel tanks if owners send in the warranty card. STI also provides a method to determine tank type and manufacturer (see Appendix F).



Source
FUELING EQUIPMENT SOLUTIONS
SOLUTIONS Design Group

Figure 4. Station equipment diagram

Source: Diagram provided by Source North America, a fueling equipment distributor.

Table 2. Station Equipment List-Materials and Function

#	Equipment	UL	UL Std.	Test w/ fuel	Ethanol Test fluids	Materials	Function
1	Tank-steel	yes	58	no	none	steel	Stores fuel.
1	Tank-fiberglass	yes	1316	yes	E100	fiberglass	Stores fuel.
1	Tank-external corrosion protection Jacketed steel tank	yes	1746	yes[a]	E100[a]		Protects tank from corrosion.
1	Tank-lining and upgrades	yes	1856	yes	E100		General tank protection.
1	Tank-above ground	yes	142/142A	no	none	fiberglass or steel	Stores fuel.
1	Tank-above ground fire protection	yes	2080/2085	no	none		Protects tank from fire.
2	Tank straps	no				metal, fiberglass, and other	Outside of tank and usually made of concrete. Devices installed in storage tank excavations to prevent tanks from floating out of the ground in event of a high level of groundwater in the excavation or a high groundwater level after the installation is complete.
3	Sump and cover (tank)	yes	2447	yes	E85	polyethylene, fiberglass	Contains spills from a tank.
4	Sump entry fitting (boot)	yes	2447	yes	E85	fiberglass, bronze, stainless steel, nitrile rubber	These seals provide a studded flange connection to create a positive and secure seal where the rubber contacts the sump wall and also around the pipe or conduit.
5	Sump penetration fittings	yes	2447	yes	E85	fiberglass or flexible plastic	A fitting that provides a liquid and vapor-tight seal around both the piping or conduit and the wall of a containment sump.
6	Flexible entry boots (conduit entry)	yes	no	no	none	glass filled nylon, nitrile	Pipe where electric wires are inserted.
7	Submersible turbine pump	yes	428 428A	yes	E10 E25 and/or E85	cast aluminum, steel, flurocarbon	Delivers fuel from the tank to the dispenser.
8	Mechanical line leak detector	yes	1238	no	none	brass, stainless steel, copper, fluorocarbon	A device used to detect the presence of a leak in the piping. Usually connected to the STP.
9	Ball valve	yes	842 842A	yes	E10 E25 and/or E85	brass, plated steal, vinyl, fluorocarbon	A valve in a piping system that allows or stops flow of fuel.
10	Magnetostrictive probe	yes	1238	no	none	stainless steel, nitrile rubber	A form of measurement technology used in in-tank electronic monitoring systems.This is a leak detection method that relies on sound waves and a magnet.
11	Float kit	yes	1238	no	none	nitrile rubber, fluoropolymer	Works in conjunction with the magnetostrictive probe to determine inventory and identify leaks.
12	Interstitial sensor	yes	1238	no	none		An electronic device that can detect the presence of water, liquid product, product vapors or a loss of pressure or vacuum in the interstice of a tank, a tank top sump, fuel dispenser sump, or observation well.
13	Manhole-composite	yes	2447	yes	E85	fiberglass, steel, resin, nitrile	Manhole covering the STP sump.

a-only part III provides ethanol listing for jacket tanks with secondary contaiments; other methods covered in parts I, II, and IV list for flammable liquids rather than specific fuels

#	Equipment	UL	UL Std.	Test w/ fuel	Ethanol Test fluids	Materials	Function
14	Manhole-multi-port spill containment	no				fiberglass, steel, aluminum, iron, polyethelene, resin, nitrile	Provides spill containment for UST fill pipes and vapor recovery risers. They are installed on top of the tank sump.
15	Spill bucket	yes	2447	yes	E85	cast aluminum, cast iron, polyethylene, stainless steel, nitrile	Prevents spilled product from entering the soil near the fill and vapor return riser connections on underground storage tanks during normal tank filling operation, or if the tank overfilled.
16	Fuel grade ID tag	yes	969	no	none		Identifies fuel being stored.
17	Fill adaptor (top or side)	yes	2583	yes	E85	Bronze, nylon, stainless steel, nitrile rubber, fluorocarbon	A permanent fitting at the top of the fill pipe of an underground storage tank that allows for a delivery hose to be quickly connected to the fill pipe in a liquid tight manner.
18	Fill cap (top or side)	yes	2583	yes	E85	brass, epoxy coated aluminum	A cap that fits over the open end of a fill pipe.
19	Vapor adaptor	yes	2583	yes	E85	bronze, conductive nylon, stainless steel, nitrile	A special fitting in a Stage I vapor recovery system that is installed at the top of the vapor recovery riser in two-point and manifolded Stage I vapor recovery systems. The vapor recovery adaptor mates to the vapor recovery elbow attached by the fuel delivery driver prior to a delivery.
20	Vapor cap	yes	2583	yes	E85	aluminum, glass filled nylon, iron, copper, stainless steel, nitrile	A dust cover for the vapor recovery system.
21	Face seal adaptor (threaded riser adaptor)	yes	2583	yes	E85	aluminum	Connects fill pipe to swivel fill adaptor and Provides a flat, true sealing surface on threaded fill pipe where a gasket seal exists. is installed on the fill pipe riser below the spill container to provide a true sealing surface for the drop tube flange on the overfill prevention valves.
22	Jack screw kit	yes	2583	yes	E85	steel	The jack screw is designed to lock an overfill valve or a drop tube into an a spill container base below the outlet of the drain valve.
23	Overfill prevention valve	yes	2583	yes	E85	cast aluminum, nitrile rubber, fluoro based seals, acetal, stainless steel, acetal, closed cell foam	Prevents the overfill of underground storage tanks by providing a positive shut-off of product delivery.
24	Drop tube (often a part of #23)	yes	2583	yes	E85	stainless steel	Delivers fuel from fill cap to bottom of tank resultig in less vapors.
25	Fuel grade ID #	yes	969	no	none		Identifies fuel type.

#	Equipment	UL	UL Std.	Test w/ fuel	Ethanol Test fluids	Materials	Function
26	Extractor tee	yes	2583	yes	E85	cast iron, zinc	A fitting that allows access to ball valve be removed or repaired without the necessity of breaking concrete, digging down to the component, or cutting a hole in the tank.
28	Ball float vent valve (flow restriction device FRD)	yes	2583	yes	E85	Brass, chrome, fluoro based seals	During a product delivery, as the tank level rises, a counterweight stainless steel ball seats on the valve body and restricts flow of vapors back to the transport truck.
27	Monitoring well screen (pipe)	no	no	no	none	plastic, polypropylene (filter wrapping the pipe)	A slotted or screened tube or pipe, positioned vertically in an underground tank excavation, that permits an operator to check conditions in the excavation and, in particular, to determine whether there may be a leak in the tank system.
29	Well cap-monitoring	yes	2583	yes	E85	plastic, nitrile rubber	Provides access to well screen.
30	Manhole-monitoring	no				cast iron	Any tank opening, including those where delivery and vapor return hoses are connected.
31	Interstitial cap	yes	2583	yes	E85		Interstitial Caps are installed on tank riser pipes to help prevent vapors from escaping or water from entering the tank
32	Manhole	no				fiberglass, steel, resin, nitrile	Access to UST system.
33	Roll filter fabric	no				polypropylene, or polyester	A porous synthetic fabric, used in underground storage tank excavations, to provide a barrier between different types of soil, or between backfill and adjacent soil.
34	Transition sump-vent	yes	2447	yes	E85	polyethylene, fiberglass	A liquid tight container typically installed at a point where product piping from an aboveground storage tank transitions to underground piping. Other forms of transition sumps may accomodate piping from an UST tank to AST generators, or for piping that resides only below grade. The transition sump exists to contain any contaminants that may leak from any piping or their connectors and to isolate and protect metallic components or equipment from the elements.
35	Sump sensor	yes	1238	no	none		An electronic device that can detect the presence of water, liquid product, product vapors or a loss of pressure or vacuum in the interstice of a tank, a tank top sump, fuel dispenser sump, or observation well.
36	Pipe	yes	971	yes	E100	fiberglass or flexible plastic	Delivers fuel between different pieces of equipment in the refueling system.
37	Pipe adaptor	yes	971	yes	E100	aluminum, stainless steel, nitrile rubber or fluoro based elastomers	connect fuel delivery transport truck hoses or nozzles to the fill pipe of an aboveground storage tank
38	Flexible connector	yes	2039	yes	E85	stainless steel, fluoro based elastomers or nitrile rubber	Flexible Connectors can be used as a convenient means of connecting piping to pumps and dispensers and throughout the piping systems where connections and changes of direction are necessary.

#	Equipment	UL	UL Std.	Test w/ fuel	Ethanol Test fluids	Materials	Function
39	Vent	yes	2853	yes	E85	aluminum, brass	A pipe, usually 2 inches in diameter, that extends from a gasoline storage tank at a service station to a point 12 feet or more above grade level. The vent allows vapors that build up in the tank to escape and outside air to enter, thus keeping the tank at atmospheric pressure when liquids are added or removed.
40	Steel bumper	no				steel	Not fuel wetted. Designed to protect dispenser from vehicle impact.
41	Dispenser	yes	87 87A	yes	E10 E25 and/or E85	multiple parts/materials (metal, plastic, elastomers) in a dispenser-treated as a whole piece of equipment	The dispenser delivers fuel from the piping connected to the STP through the hanging hardware into a vehicle. It has numerous parts including meters, valves, seals, and electronics.
42	Nozzle	yes	2586 2586A	yes	E10 E25 and/or E85	aluminum, plastic, fluorocarbon	A device consisting of a spout, handle and operating lever, attached to the end of a hose and used for controlling the flow of a liquid motor fuel.
43	Breakaway	yes	567 567A	yes	E10 E25 and/or E85	steel, zinc, nylon, acetal, fluorocarbon	A device that disconnects dispenser from hanging hardware if a vehicle pulls away with the nozzle still in the vehicle gas tank.
44	Swivel	yes	567 567A	yes	E10 E25 and/or E85	aluminum, zinc, nitrile rubber	The swivel permits the nozzle to be rotated without rotating the hose at the same time.
45	Whip hose	yes	330 330A	yes	E10 E25 and/or E85	nitrile rubber	A short length of hose with threaded fittings at both ends that is usually installed adjacent to a breakaway valve. The whip hose ensures that forces exerted during a drive off are aligned with the axis of a breakaway valve.
46	Hose	yes	330 330A	yes	E10 E25 and/or E85	nitrile rubber	Delivers fuel to the nozzle.
47	Hose retractor	no				aluminum, polyester	A cable device, fixed to a gasoline station hose and dispenser, to pull the hose back to its storage position after it has been used. Usually used for longer hoses that allow refueling on either side of a vehicle.
48	Stablizer bar kit	yes	2447	yes	E85	steel	Provides support in a dispenser sump to attach the shear valve.
49	Shear valve	yes	842 842A	yes	E10 E25 and/or E85	cast iron, stainless steel, fluorocarbon	Cuts off the flow of fuel from the UST system in the event of vehicle impact, fire, or other catastrophe.
50	Shear valve-vapor (stage II only)	yes	842 842A	yes	E10 E25 and/or E85	cast iron, stainless steel, fluorocarbon	A fitting installed in the vapor piping at the base of a dispenser that is designed to “shear” or break off if the dispenser cabinet is dislodged from its base.

#	Equipment	UL	UL Std.	Test w/ fuel	Ethanol Test fluids	Materials	Function
51	Sensor tube	yes	1238	no	none		Contains the sump sensor.
52	Dispenser sump	yes	2447	yes	E85	fiberglass, flexible plastic	A container designed to contain leaks from dispensers
53	Pipe-secondary containment tee	yes	971	yes	E100	flexible plastic, fiberglass	A pipe fitting connector
54	Pipe-product tee	yes	971	yes	E100	flexible plastic, fiberglass	A pipe fitting connector
55	Concentric reducer	yes	2447	yes	E85		A seal that connects the sump entry/termination fitting to secondary containment pipe.
56	Pipe-product	yes	971	yes	E100	flexible plastic, fiberglass	Delivers fuel between tank and dispenser.
57	Pipe-secondary containment elbow	yes	971	yes	E100	flexible plastic, fiberglass	A pipe fitting that makes a right-angle turn
58	Pipe-product elbow	yes	971	yes	E100	flexible plastic, fiberglass	A pipe fitting that makes a right-angle turn
40	Steel bumper	no				steel	Protects equipment from vehicle impact.
59	Console	yes	1238	no	none		A control unit, containing switches, keys, or similar elements, used to control the operation of a dispenser or other device at a gasoline dispensing facility.
60	Probe cap adaptor	yes	2583	yes	E85	cast aluminum, nitrile rubber	Monitoring Probe Caps are installed on tank riser pipes to help prevent vapors from escaping or water from entering the tank. Monitoring Probe Caps include a wire grommet fitting to accommodate the electronic tank gauge probe.

4.1 Dispensers, Hanging Hardware, Shear Valves, and STPs

There are multiple dispenser options to sell E15: retrofit an existing dispenser with a UL-listed kit, purchase a UL-listed E25 dispenser (minimal cost over conventional E10 dispenser), or purchase a UL-listed E85 blender pump dispenser (higher cost but more options for fuel offerings). Both Gilbarco and Wayne provide UL-listed dispensers for blends above E10. Credit card companies are requiring retail fueling stations to update their dispensers to accept new chip and PIN secure credit cards by October 2017, at which time fraud liability would switch to station owners if they have not updated their equipment. This presents an opportunity to increase E25 UL-listed equipment through either a retrofit kit if electronics are being upgraded to accommodate the new credit cards, or if a station must purchase a new dispenser, they could pay a minimal amount more for an E25 dispenser.

Hanging hardware includes hoses, nozzles, breakaways, and swivels (Figure 5). OPW obtained E25 listing for a conventional swivel and breakaway, for which there is no price premium. Husky offers UL-listed E25 and E85 nozzles while OPW offers a UL-listed E85 nozzle. EMCO Wheaton, IRPCO, and Veyance have hoses warrantied for E15, and Veyance has a UL-listed E85 hose product. A best practice is to replace all hanging hardware with E15-compatible equipment.

Shear valves are an important piece of safety equipment that cut off the flow of fuel from the UST to the dispenser to prevent a release in the event of an accident dislodging the dispenser or fire. UL-listed E85 shear valves are available from Franklin Fueling and OPW.

STPs draw fuel from the tank and into piping that delivers the fuel to the dispenser. Both Veeder-Root and Franklin Fueling offer UL-listed E85 pumps.

Appendix B lists specific manufacturers and models for use with blends above E10.

Figure 5. Aboveground equipment

(NREL 13531)

4.2 Tanks, Pipes, and Other UST Equipment

4.2.1 Compatibility of Tanks

Most tanks are compatible with ethanol blends above E10. Appendix B lists tank manufacturers and their compatibility with ethanol blends. If a station owner does not have equipment lists, the information in Appendix F describes methods to determine tank type.

All existing steel tank companies manufacturing tanks to store transportation fuels have issued signed letters stating compatibility with up to E100 per EPA OUST biofuels guidance. Tanks are listed under UL 58, which does not expose tanks to test fluids. All STI members who fabricate regulated fuel USTs in the United States have UL 58 listings. STI conducted independent testing and determined that steel tanks are compatible with all ethanol blends.

Xerxes and Containment Solutions manufacture fiberglass tanks, and both have E100 listing for their products under UL 1316.[11] Per EPA OUST's biofuels guidance, Containment Solutions issued a letter stating that all tanks it has manufactured are compatible all ethanol blends. Xerxes and Owens Corning (which no longer manufactures tank) have stated that compatibility depends on tank type and the year manufactured. Appendix C includes specific information on fiberglass tank compatibility.

The following is from a Fiberglass Tank and Pipe Institute paper on ethanol compatibility (Curran 2015):

> *"By 1990, Institute member fiberglass tank manufacturers had modified their tanks constructions to handle gasoline with any level of ethanol or methanol up to 100% for all double-wall fiberglass tanks and in some cases single- wall fiberglass tanks. In 1992, Owens Corning, the manufacturer of the oldest UL Listed fiberglass tanks for petroleum service, advised certain major oil companies that some tanks were approaching 30 years in age and their 30-year warranties would expire. As a result, the affected companies conducted surveys of these older tanks, including tanks in E-10 ethanol service (e.g., in the Midwest) and confirmed that the tanks were performing satisfactorily for continued service. In summary, technical evaluations and historical experience demonstrated that there is no material or technical reason why properly installed pre-1988 piping and tanks in conventional gasoline or MTBE service should not perform equally as well when handling 10 percent ethanol blends."*

4.2.2 Compatibility of Pipes

Installed pipes are evenly split between fiberglass and flexible plastic pipes. Piping is listed under UL 971. E100 became an eligible test fluid in 1988, and all existing pipe companies have E100 listing (Appendix D). Fiberglass was the primary pipe type for decades. NOV is the only existing company providing fiberglass piping in this market, and its products received E100 listing in 1990. NOV provides a 30-year warranty.

Flexible pipes entered the marketplace in the 1990s after EPA OUST recommended development of jointless pipes. There were some issues with initial deployment and failures of Total Containment piping. Total Containment is no longer in business, and its piping is largely

[11] Decades-old fiberglass tanks may only be approved for use with E10; please refer to Appendix C.

believed to have been replaced. This occurred before E10 was widely available. Over time, more robust products were developed, and all existing flexible plastic pipe manufacturers have UL listing for E100. These manufacturers include Advantage Earth Products, Brugg Pipesystems,[12] Franklin Fueling, NUPI, Omega Flex, and OPW. Both Franklin Fueling and Omega Flex require the use of stainless steel pipe fittings for blends above E10. A typical warranty for flexible pipes is 10 years.

It is likely that there are stations using piping from companies no longer in business, and the compatibility with ethanol blends for these products is unknown.

4.2.3 Other UST Equipment

Other associated UST equipment includes sumps and accessories, manholes, flexible connectors, fill caps and adaptors, entry fittings, overfill prevention, leak detection, sensors, drop tubes, vents, and similar. Per EPA OUST's biofuels guidance, several manufacturers have issued letters for specific products and model numbers stating compatibility with various ethanol blends above E10. Some major manufacturers have not issued letters but have provided statements on their website product pages that the products are compatible with various ethanol blends, including E15, E85, and E100. Most manufacturers have their own laboratories where they test their products with fuels. Some smaller manufacturers likely rely on materials analysis to determine compatibility. Appendix D provides a list by manufacturer of compatible equipment.

While UL now has listing standards for most of this equipment, few products have UL listing for E10 and even fewer for blends above E10. This does not mean that the products are not compatible, just that manufacturers have yet to obtain listings.

Retailers should specifically investigate if their leak detection equipment is compatible with E15 (refer to Appendix E). Leak detection equipment is required by federal regulations developed by EPA OUST (EPA 2015b). All federally regulated UST systems (tanks and piping) storing motor fuel must have leak detection equipment to detect any potential releases so the spread of contamination can be stopped before significant environmental impact occurs. Regulations allow for several types of leak detection methods. The National Work Group on Leak Detection Evaluations has developed test protocols for various technologies with blends above E10 (NWGLDE 2011). It is expected that some will function with ethanol blends while others may require testing to determine functionality.

In 2011, Battelle conducted a test of ethanol-blended fuels and an automatic tank gauging system to determine water detection functionality (Carvitti and Gregg 2010). E0 was used as a baseline, and E15 and E85 were tested. Fuel was tested at two tank levels—25% and 65% full. Two methods of water ingress were used: a continuous stream of water into a tank, and a quick water dump followed by a fuel dump. An automatic tank gauging system has a float that performs two functions: product level monitoring that leads directly to leak detection; and water detection. The water detection function detected the water stream with E0 and E15 but was not conclusive for E85.

[12] Brugg Pipesystems manufacturers stainless steel pipes, which are rarely used at United States stations.

As a result of the E15 waiver request, the American Petroleum Institute funded a study to determine compatibility of some associated UST equipment, specifically tank vapor recovery equipment and overfill protection devices with E15 (Ken Wilcox Associates 2011). The testing protocol was to expose equipment to test fluids E10 (control) and aggressive E17 (test fluid formula from UL) for four weeks at 140°F followed by performance testing. The following equipment was tested: ball float vent valve, monitoring probe cap, overfill prevention valve, replacement drain valve kit (used to drain spill container after an overfill during delivery), swivel product adaptor, and swivel vapor adaptor. The report states that most of the equipment performed well during testing. All ball float vent valves, monitoring probe caps, and replacement drain valve kits passed. Two of three overfill prevention valves passed; the failing product was stuck in the OFF position during performance testing. Swivel product adaptor results were mixed, with one product failing on E10 and passing on aggressive E17 while the other product failed on both fuels. Swivel vapor adaptors did not perform well either with one failing on both test fluids and a second product failing on the E17 test fluid. The adaptor failures happened during performance testing due to leaks in sealing materials. Most manufacturers have upgraded sealing materials in the past few years after this test was performed to address the introduction of more ethanol and ULSD into the market.

The subject of older pipe dopes/sealants and their compatibility with ethanol fuels came up in the course of the original E15 infrastructure work performed by U.S. Department of Energy national laboratories. Pipe dope, also referred to as pipe thread sealant, is a sealing product used to make pipe thread joints leak proof and pressure tight. Refueling equipment with threaded ends is designed to achieve a tight fit during proper assembly but it is a regular practice to use pipe dope in some instances. Appendix G is a diagram of where pipe dope might be used in a refueling system. Jobbers who install, fix, and replace equipment at stations always have a jar of pipe dope available for use and the two main brands are RectorSeal and Gasoila. Gasoila's pipe thread sealants have used the same formula for decades and are compatible with ethanol blends up to 20%.[13] RectorSeal No.5 is their best selling product for use at refueling station and the manufacturer said it has long been compatible with ethanol blends including E15.[14]

[13] Gasoila pipe thread sealants are compatible with up to 20% ethanol. Blends above E20 need to use their Gasoila E-Seal product. http://www.gasoila.com/products/pipe-thread-sealants.html

[14] RectorSeal's Pipe Thread Sealant Chart shows No.5 as compatible with gasohol (10%), however, NREL spoke with their technical staff who said it is compatible with E15.

5 Conclusions

This study found that significant changes to safety testing standards have incorporated fuel blends with more than 10% volume ethanol. This has led to many refueling equipment products compatible with E15. A station owner can compare its equipment records against the compatibility list in the appendices of this report to determine if there is a need to update or upgrade any equipment to sell E15. The majority of tanks are compatible as existing pipe manufacturers have had listing for E100 for many years, UL-listed E25 dispensers and retrofit kits are available, as is hanging hardware (a combination of E25 and E85 UL-listed equipment). Many manufacturers' models, as well as other UST equipment including fill equipment, leak detection, overfill prevention, and containment, are compatible with E15.

A literature review was conducted to determine if there were any negative impacts during the multi-year deployment of E10 nationwide. No incidents of E10 causing releases were identified, and no infrastructure industry experts suggested that there were widespread issues with E10.

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Appendix A. EPA OUST Release Data

2009 release data from 47 states:

	Cause															
Source	**Total**		**Spill**		**Overfill**		**Phys/Mech Damag**		**Corrosion**		**Install Problem**		**Other**		**Unknown**	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Tank	1616	31.3%	37	19.0%	59	24.0%	179	23.3%	321	83.2%	9	16.7%	157	33.7%	854	28.0%
Piping	720	13.9%	9	4.6%	6	2.4%	190	24.7%	48	12.4%	25	46.3%	43	9.2%	399	13.1%
Dispenser	655	12.7%	38	19.5%	31	12.6%	160	20.8%	8	2.1%	9	16.7%	49	10.5%	360	11.8%
STP	76	1.5%	4	2.1%	2	0.8%	36	4.7%	1	0.3%	5	9.3%	9	1.9%	19	0.6%
Delivery Problem	342	6.6%	92	47.2%	121	49.2%	100	13.0%	0	0.0%	1	1.9%	14	3.0%	14	0.5%
Other	564	10.9%	14	7.2%	6	2.4%	97	12.6%	6	1.6%	4	7.4%	171	36.7%	266	8.7%
Unknown	1195	23.1%	1	0.5%	21	8.5%	8	1.0%	2	0.5%	1	1.9%	23	4.9%	1139	37.3%
Totals	5168		195		246		770		386		54		466		3051	

Source: Eighmey, C. LUSTLine Bulletin #67. March 2011

Appendix B. Aboveground Compatibility

Manufacturer	Product	Model	E%	UL listed	UL listed for this fuel?
Franklin Fueling	Shear valve	662 models (UL listing for #662502902)	E85	yes	yes
Franklin Fueling	Submersible turbine pump	FE Petro STPAG, IST	E85	yes	yes
Gilbarco	Dispenser, Retofit Kit	E25 option on any dispenser; E25 retrofit kit	E25	yes	yes
Gilbarco	Dispenser	Encore Flex Fuel	E85	yes	yes
EMCO Wheaton	Breakaway	A2119, A2219, A3019, A3219, A4119EVR	E15	yes	no
EMCO Wheaton	Breakaway	A4119-020E	E85	no	
EMCO Wheaton	Hose	all	E15	yes	no
EMCO Wheaton	Nozzle	A4005-002, A4005-004, A4015-002, A4015-004	E15	yes	no
EMCO Wheaton	Nozzle-balance vapor recov	A4005-002E, A4015-002E	E85	yes	no
EMCO Wheaton	Swivel	A0360 (not listed), A4110EVR (UL listing)	E15	yes	no
Husky	Nozzle	X E25, X E25, XSE25	E25	yes	yes
Husky	Nozzle	X E85, X E85 Cold Weather, XS E85, XS E85 Cold Weather	E85	yes	yes
IRPCO	Hose-dispenser	Steelflex Ultra Hardwall, Softwall (2 Braid, 4SP), Marina	E15	yes	no
OPW	Breakaway	66V-0300	E25	yes	yes
OPW	Breakaway	66V-0492	E85	yes	yes
OPW	Nozzle	21GE, 21GE-A	E85	yes	yes
OPW	Swivel	241TPS-0492	E85		
OPW	Swivel	241TPS-0241, 241TPS-1000, 241TPW-0492	E25	yes	yes
OPW	Shear valve	10P-0142E85, 10-P-4152E85	E85	yes	yes
Veeder-Root	Submersible turbine pump	Redjacket, Redjacket AG,	E100	yes	no
Veyance	Hose	Flexsteel Futura Ethan-all	E85	yes	yes
Veyance	Hose	Flexsteel Futura	E15	yes	no
Wayne	Dispenser	E25 option on any dispenser; E25 retrofit kit	E25	yes	yes
Wayne	Dispenser	Ovation E85, Helix E85	E85	yes	yes

For compatibility of older dispensers with E85, please refer to: DOE Clean Cities. *Handbook for Handling, Storing, and Dispensing E85 and Other Ethanol-Gasoline Blends*. September 2013. http://www.afdc.energy.gov/uploads/publication/ethanol_handbook.pdf

Appendix C. Tank Compatibility

Tank Manufactuer Compability with Ethanol Blends	
Manufacturer	**Compatibility Statement with Ethanol Blends**
FIBERGLASS[1]	
Containment Solutions	Tanks manufactured after January 1, 1995 are all compatible with ethanol blends up to 100% (E100) (UL Listed)
Owens Corning	
Single Wall Tanks	Tanks manufactured between 1965 and 1994 are approved to store up to 10% ethanol (E10)
Double Wall Tanks	Tanks manufactured between 1965 and July 1, 1990 are approved to store up to 10% ethanol (E10) .
	Tanks manufactured between July 2, 1990 and December 31, 1994 were warranted to store any ethanol blend.
Xerxes	
Single Wall Tanks	Tanks manufactured prior to 1981 are not compatible with ethanol blends
	Tanks manufactured from February 1981 through June 2005 are designed for the storage of ethanol fuel up to a 10% blend (E10)
	Tanks manufactured from July 2005 to date are designed for the storage of ethanol fuel blends up to 100% (E100) (UL Listed)
Double Wall Tanks	Tanks manufactured prior to April 1990 were designed for the storage of ethanol fuel up to a 10% blend (E10)
	Tanks manufactured from April 1990 to date are designed for the storage of ethanol fuel blends up to 100% (E100) (UL Listed)
STEEL[2]	
Acterra Group Inc.	Compatible with all blends up to 100% (E100)
Caribbean Tank Technologies Inc.	Compatible with all blends up to 100% (E100)
Eaton Sales & Service LLC	Compatible with all blends up to 100% (E100)
General Industries	Compatible with all blends up to 100% (E100)
Greer Steel, Inc.	Compatible with all blends up to 100% (E100)
Hall Tank Co.	Compatible with all blends up to 100% (E100)
Hamilton Tanks	Compatible with all blends up to 100% (E100)
Highland Tank	Compatible with all blends up to 100% (E100)
J.L. Houston Co.	Compatible with all blends up to 100% (E100)
Kennedy Tank and Manufacturing Co.	Compatible with all blends up to 100% (E100)
Lancaster Tanks and Steel Products	Compatible with all blends up to 100% (E100)
Lannon Tank Corporation	Compatible with all blends up to 100% (E100)
Mass Tank Sales Corp.	Compatible with all blends up to 100% (E100)
Metal Products Company	Compatible with all blends up to 100% (E100)
Mid-South Steel Products, Inc	Compatible with all blends up to 100% (E100)
Modern Welding Company	Compatible with all blends up to 100% (E100)
Newberry Tanks & Equipment, LLC	Compatible with all blends up to 100% (E100)
Plasteel[1]	Compatible with all blends up to 100% (E100)
Service Welding & Machine Company	Compatible with all blends up to 100% (E100)
Southern Tank & Manufacturing Co., Inc.	Compatible with all blends up to 100% (E100)
Stanwade Metal Products	Compatible with all blends up to 100% (E100)
Talleres Industriales Potosinos	Compatible with all blends up to 100% (E100)
Tanques Antillanos C. x A.	Compatible with all blends up to 100% (E100)
Watco Tanks, Inc.	Compatible with all blends up to 100% (E100)
We-Mac Manufacturing Company	Compatible with all blends up to 100% (E100)
Letters stating compability 1 PEI http://www.pei.org/PublicationsResources/ComplianceFunding/USTComponentCompatibilityLibrary/tabid/882/Default.aspx 2 STI http://www.steeltank.com/Publications/E85BioDieselandAlternativeFuels/ManufacturerStatementsofCompatibility/tabid/468/Default.aspx	

Appendix D. Pipe Compatibility

Manufacturer	Product	Model	E%	UL listed	UL listed for this fuel?
Advantage Earth Products	Pipe	1.5", 2", 3", 4"	E100	yes	yes
Brugg Pipesystems	Pipe	FLEXWELL-HL, SECON-X, NIROFLEX, LPG	E100	yes	yes
Franklin Fueling	Pipe	XP, UPP	E100	yes	yes
Franklin Fueling	Pipe ducting	APT, UPP	E100	yes	yes
Franklin Fueling	Pipe fittings	XP stainless steel (ELB-XP-150, ELB-XP-175, ELB-XP-200, GSHP-150, GSHP-200, MS-XP-150-150SS, MS-XP-175-200SS, MS-XP-200-200SS, MS-100-100SS, MS-XP-150-150, MS-XP-SW-175-200, MS-XP-SW-200-200, QRS-XP-150-200, QRS-XP-175-200, QRS-XP-200-200, SSC-150, SSC-200, SSE90-150, SSE90-200, SSE90-150, SST-150, SST-200, SSU-150, SSSHP-150, TEE-XP-150, TEE-XP-175, TEE-XP-200) UPP stainless fittings	E85	yes	yes
NOV Fiberglass	Red Thread IIA	fiberglass	E100	yes	yes
NUPI	Smartflex	flexible plastic	E100	yes	yes
OMEGAFLEX	DoubleTrac	flexible plastic (must use stainless steel fittings)	E100	yes	yes
OPW	Pipe	FlexWorks, Pisces (discontinued)	E100	yes	yes
OPW	Pipe adaptors, couplers, fittings	FlexWorks	E100	yes	yes

Appendix E. Other UST Equipment Compatibility

Note: “UN” in the E% column indicates the manufacturer does not know if it is compatible with ethanol blends. ? = waiting on information from OEM

Manufacturer	Product	Model	E%	UL Listed	UL listed for this fuel	Other Approval
Clay and Bailey	AST anti-siphon valve	405	E10	no		
Clay and Bailey	AST manhole	API-650	E85	no		
Clay and Bailey	AST alarm	1400	E10	no		
Clay and Bailey	AST overfill prevention valve	1228	E85	yes	no	
Clay and Bailey	AST pressure vacuum vent	88	E10	no		
Clay and Bailey	AST spill containment	all	E85	no		
Clay and Bailey	AST emergency vent	354, 365, 366, 367, 368, 369, 370	E85	yes	no	
Clay and Bailey	Manhoes	all	E10	no		
Clay and Bailey	Ball valve	736	E10	no		
Clay and Bailey	Fill cap	94, 232, 233, 234, 235, 254	E85	no		
Clay and Bailey	Vent-upflow	395	E10	no		
Cimtek	Filter	300, 400, 450, 475	E15	yes	no	
Cimtek	Filter	800	E85	yes	no	
EMCO Wheaton	Nozzle-balance vapor recovery	A4005-002E, A4015-002E	E85	yes	no	CARB EVR
EMCO Wheaton	Nozzle-balance vapor recovery	A4005-002, A4005-004, A4015-002, A4015-004	E15	yes	no	CARB EVR
EMCO Wheaton	Breakaway	A4119-020E	E85	no		
EMCO Wheaton	Breakaway	A2119, A2219, A3019, A3219, A4119EVR	E15	yes	no	CARB EVR (A4119 only)
EMCO Wheaton	Swivel	A0360, A4110EVR	E15	yes (EVR only)	no	CARB EVR (A4110 only)
EMCO Wheaton	Hose	all	E15	yes	no	
EMCO Wheaton	Adaptors	A0030, A0030-142, A0076, A0076-142S A0089, A0096,	E15	no		CARB EVR (both A0030 and A0076)
EMCO Wheaton	Ball float	A0075E, A0078E	E85	no		CARB EVR (A0078)
EMCO Wheaton	Ball float	A0075, A0078	E15	no		CARB EVR (A0078)
EMCO Wheaton	Caps	A0097-005, A0097-004LP, A0097-010, A0099-002, A0099-004LP	E15	no		CARB EVR (A0097-005, A0099-02)
EMCO Wheaton	Drop tube	A0020-004E, A0020-005E, A0020-007E	E15	no		CARB EVR (A0020, A0088)
EMCO Wheaton	Drop tube	A0020-004, A0020-005, A0020-007, A0020-008, A0020-021, A0020-133, A0020-144, A0070, A0088	E15	no		CARB EVR (A0020, A0088)
EMCO Wheaton	Extractor fittings	A0079	E85	yes	no	CARB EVR
EMCO Wheaton	Overfill prevention valve	A1100-010E, A1100-056SE, A1100-055SERF, A1100-056SERF, A1100EVR-057E, A1100-067E, A1100-087E	E85	no		CARB EVR
EMCO Wheaton	Overfill prevention valve	A1100-010, A1100-011, A1100-054S, A1100-054SC, A1100-054SCN, A1100-055SRF, A1100-056SRF, A1100-053S, A1100-055S, A1100EVR-055, A1100-056S, A1100EVR-056, A1100-057S, A1100EVR-057, A1100-058S, A1100EVR-058, A1100-065S, A1100-066S, A1100-067S, A1100-085S, A1100-087S, A1100-087S	E15	no		CARB EVR (only models with EVR in model no.)
EMCO Wheaton	Ball valve	A0750	E15	no		
EMCO Wheaton	Check valve	A0066, A0732	E15	no		
EMCO Wheaton	Shear valve	A0060 with stainless steel body	E85	yes	no	
EMCO Wheaton	Shear valve	A0060 with cast iron body, A0063	E15	yes	no	
EMCO Wheaton	Vent	A0084, A0085, A4103, A0785	E15	yes (A4103 only)	no	
Husky	Pressure vacuum vents	4620, 4885, 5885, 8060	E85	yes	yes	

Manufacturer	Product	Model	E%	UL listed	UL listed for this fuel?	Other Approval
STP Equipment						
Franklin Fueling	Mechanical line leak detector	MLD+AG	E85	yes	?	
Franklin Fueling	Mechanical line leak detector	STP-MLD	E10	yes	yes	
Franklin Fueling	Shear valve (emergency shear	662 models	E85	yes (66250 2902)	yes	
Franklin Fueling	Shear valve-vapor	362 models	UN	no		
Franklin Fueling	Submersible pump controller	MagVFC IST,	E85	yes		
Franklin Fueling	Submersible turbine pump	STP	E10	yes	yes	
Franklin Fueling	Submersible turbine pump	FE Petro STPAG, IST	E85	yes	yes	
Fill Equipment						
Franklin Fueling	Ball float vent valve	308 models	E85	no		EVR CARB
Franklin Fueling	Drop tube	306 and 708 models, 782-204-30-2, 782-204-32-2, 782-202-12, 782-203-12, 782-204-10-2, 782-204-12-2, 782-204-15-2	E85	no		
Franklin Fueling	Extractor vent valve (tee)	300 series models	E85	no		
Franklin Fueling	Fill adaptor-side	776-300-01, 776-300-31	E85	no		
Franklin Fueling	Fill adaptor-swivel	SWF-100-SS, SWFV-PKGSS	E85	no		EVR CARB
Franklin Fueling	Fill adaptor-swivel	SWFV-PKG, 705-412-01, 705-412-02	E85	no		
Franklin Fueling	Fill adaptor-top	778-301-05	E85	no		EVR CARB
Franklin Fueling	Fill adaptor-top	776-300-01, 776-300-31, 778-301-01, 778-301-02, 778-301-06, 778-301-32, 778-301-01, 778-302-31, 778-303-02, 778-303-32, 780-200-01	E85	no		
Franklin Fueling	Fill cap-side	775 series	E85	no		
Franklin Fueling	Fill cap-top	777-201-02	E85	no		EVR CARB
Franklin Fueling	Fill cap-top	777-202-01, 777-202-02, 779-200-01, 774-202-03	E85	no		
Franklin Fueling	Vapor cap	304-301-03	E85	no		EVR CARB
Franklin Fueling	Vapor cap	304-200-01, 304-200-02, 304-301-01, 304-301-02	E10	no		EVR CARB (301-01 only)
Franklin Fueling	Vapor pipe adaptor	SWV-101-SS, SWFV-PKGSS	E85	no		EVR CARB
Franklin Fueling	Vapor pipe adaptor	SWV-101-B, SWFV-PKG, 705-413-01, 705-413-02	E10	no		
Franklin Fueling	Vapor recovery adaptor	306 and 708 models	E85	no		
Franklin Fueling	Overfill prevention valve	708-491-31, 708-491-32, 708-492-21, 708-492-22, 708-492-31, 708-492-32, 708-498-11	E85	yes	?	EVR CARB (ending in 11 or 12)
Franklin Fueling	Overfill prevention valve	708-491-01, 708-491-02, 708-491-11, 708-491-12, 708, 491-21, 708-492-01, 708-492-02, 708-498-11, 708-493-03, 708-493-04, 708-493-23, 708-493-24, 708-340-901, 708-494-02, 708-494-03, 708-494-04, 708-498-01, 708-498-02, 708-498-03	E10	yes	?	EVR CARB
Franklin Fueling	Probe cap and adaptor kit	90037-E	E85	no		EVR CARB
Franklin Fueling	Spill container (bucket)	702, 703, 705, 715	E10	yes (705 and 715 models only)		yes (705 and 715 models only)
Franklin Fueling	Spill container (bucket)	Phil-Tite series, Defender Series	E85	yes	?	EVR CARB
Franklin Fueling	Tank bottom protector	TBP-3516-E	E85	no		
Franklin Fueling	Tank bottom protector	785-200-02	E10	no		
Franklin Fueling	Vent valve (pressure/vacuum)	PV-ZERO models	E85	yes	?	EVR CARB

Manufacturer	Product	Model	E%	UL listed	UL listed for this fuel?	Other Approval
UST Equipment						
Franklin Fueling	API adaptor	880-500-04	E85	no		
Franklin Fueling	Automatic tank gauge	TSP	E10	yes	yes	
Franklin Fueling	Ball valve (for pipe)	FLEX-ING	E85	yes	no	CSA
Franklin Fueling	Check valve	622-300-01, 65, 515, 516, 615, 635, 650	E10	no		
Franklin Fueling	Dispensing cutoff system	DC400	E10	no		
Franklin Fueling	Flexible connectors	FLEX-ING	E10			
Franklin Fueling	Flexible connectors	FIREFLEX	E85	yes	no	
Franklin Fueling	Float kit	TSP-IGF4P	E15	no		
Franklin Fueling	Float kit	TSP-IGF4D3, TSP-IGF4D	E85	no		
Franklin Fueling	Foot valve	50-201, 320	E10	no		
Franklin Fueling	Interstitial sensor	TSP-HIS, TSP-DIS, TSP-EIS, TSP-HFS	E85	no		
Franklin Fueling	Level sensor	TSP-HLS	E85	no		
Franklin Fueling	Magnostrictive probe	Moorman	E85	no		
Franklin Fueling	Manhole	14U, 20UR, 780, 781, 789, 808, 810, 814, 987, Defender, SSQ, SR series	E10	no		
Franklin Fueling	Monitoring test well	772, 773, 808, 810	E10	no		
Franklin Fueling	Monitoring well cap	TSP-KW4	E10	no		
Franklin Fueling	Monitoring well sensor	TSP-MWS	E0	no		
Franklin Fueling	Probe installation kit	FFS	E10	no		
Franklin Fueling	Pipe fittings	GC-150, GC-200, GE90-150, GE90-200, GE90-215, GE90-252, GHB-200-150, GT-150, GT-200, GT-215, GT-252, GU-150, GU-200, GHB-200-150, GSHP-150, GSHP-200, XP brass (MS-XP-150-150, MS-XP-175-200, MS-XP-200-200	E10	yes	yes	
Franklin Fueling	Sumps	2400, 4542 (UL), 4736, APT, AST, LM, TS, UPP (UL) models	E85	yes	no	
Franklin Fueling	Sump accessories, fittings, boots	APT	E85	yes	no	
Above-ground Equipment						
Franklin Fueling	Nozzle	400, 600, 708, 709, 800, 900 series (all vapor recovery II)	E10	no		EVR CARB (400, 600, 900)
Franklin Fueling	Breakaway	697, 698, ACCUBREAK, SAFETY-SEVER	E10	yes	yes	
Franklin Fueling	Hoses	FLEX-ING	E10	no		
Franklin Fueling	Hoses	FLEX-ON	E15	yes	no	
Franklin Fueling	Swivel	465	E10	no		
Franklin Fueling	Swivel	FLEX-ING multi-plane	E10	no		
AST Equipment						
Franklin Fueling	Anti-siphon valve	636-300-11, 636-300-12	E85	no		
Franklin Fueling	Anti-siphon valve	605-300-01, 606-300-01, 616-300-01, 616-300-02, 616-300-03	E10	no		API/RP 2000
Franklin Fueling	AST emergency vent	803	E10	yes		
Franklin Fueling	AST fill cap	751, 770	E10	no		
Franklin Fueling	AST overfill prevention valve	709	E10	no		
Franklin Fueling	AST Pressure regulator valve	620, 621, 622, 644	E10	yes		API/RP 2000
Franklin Fueling	AST pressure vacuum vent	802	E10	no		
Franklin Fueling	AST spill container (bucket)	706	E10	no		
Franklin Fueling	AST tank vent	800	E10	no		

Company	Product	Model	E%	UL Listed	UL listed for this fuel	Other Approval
Morrison Bros	Adaptor-coaxial	605	UN	no		
Morrison Bros	Anodized Farm Nozzle	200S	E85	no		
Morrison Bros	Anti-Syphon Valve	912	E85	no		
Morrison Bros	AST adaptor	927	E85	no		EVR CARBa (some)
Morrison Bros	AST adaptor	926, 927B	UN	no		
Morrison Bros	AST clock gauge	818, 818C, 818F, 818MET, 818MEF, 918F, 918FT, 918MEF, 918MET, 918T, 1018GM, 8181	UN	no		EVR CARBa (some)
Morrison Bros	Ball Valves	691BSS	E85	no		
Morrison Bros	Cap relief	779	UN	no		
Morrison Bros	Caps	305C	E85	no		EVR CARBa (some)
Morrison Bros	Caps-monitoring well	305XP, 305XPU	UN	yes (XPU)		EVR CARBa (some)
Morrison Bros	Cap-test well	178XAT, 178XB, 178XA, 305XA, 678XA	UN	no		
Morrison Bros	Clock Gauge with Alarm	918	E85	no		
Morrison Bros	Clock Gauges	818	E85	no		
Morrison Bros	Combination Vent/Overfill Alarm	922	E85	no		
Morrison Bros	Diffuser	539TO, 539TC	E85	no		EVR CARBa (some)
Morrison Bros	Diffuser	539, 539EXT, 539TC, 539TO	UN	no		EVR CARBa (some)
Morrison Bros	Double Tap Bushing	184	E85	no		
Morrison Bros	Drop Tubes	419A	E85	no		
Morrison Bros	Drop tubes	275, 419, 419SOS	UN	no		EVR CARBa (some)
Morrison Bros	Emergency Vents	244	E85	yes	yes	EVR CARBa (some)
Morrison Bros	Expansion Relief Valve	076DI, 078DI	E85	no		
Morrison Bros	External Emergency Valves	346DI, 346FDI, 346SS, 346FSS	E85	no		
Morrison Bros	Extractor pipe cap	578, 578P	UN	no		
Morrison Bros	Extractors	560/561/562/563	E85	no		
Morrison Bros	Fill cap	178, 178DT, 179, 179CI, 179M, 179MCI, 180M, 305CU, 379, 405C	UN	no		EVR CARBa (some)
Morrison Bros	Fill cap and adaptor	307	UN	no		
Morrison Bros	Fill swivel adaptor	305SA	UN	no		
Morrison Bros	Flame Arrester	351S	E85	no		
Morrison Bros	Float Vent Valves	317	E85	no		
Morrison Bros	Frost Proof Drain Valve	128DIS	E85	no		
Morrison Bros	Indicator paste	490G, 490W, SAR-GEL	UN	no		
Morrison Bros	In-Line Check Valve	958	E85	no		
Morrison Bros	Internal Emergency Valves	272DI, 72HDI	E85	no		
Morrison Bros	Interstitial sensor	918TCPS, 924LS	UN	no		
Morrison Bros	Manholes	318, 318L, 318TM, 318VR, 318XA, 418, 418L, 418TM, 418XA, 418XAP, 418XAH, 418XAW, 418LC, 424, 519, 524, 524H	UN	no		

Company	Product	Model	E%	UL Listed	UL listed for this fuel	Other Approval
Morrison Bros	Mechanical gauge	1018GM	UN	no		
Morrison Bros	Overfill Alarm	918TCP	E85	no		
Morrison Bros	Overfill Prevention Valve	9095A-AV, 9095SS	E85	no		
Morrison Bros	Overfill Prevention Valve	9095AA, 9095GBT	E85	no		
Morrison Bros	Pressure Vacuum Vent	948A	E85	yes	yes	
Morrison Bros	Probe cap and adaptor	307P	UN	no		
Morrison Bros	Solenoid Valves (3" Must be all Teflon version)	710SS	E85	no		
Morrison Bros	Spill Containers	515/516/517/518	E85	no		EVR CARBa (516)
Morrison Bros	Strainer	285	E85	no		
Morrison Bros	Strainer	284B, 284S, 285AL, 285DI, 285FDI, 286, 286FDI, 286U	UN	no		
Morrison Bros	Swing Check Valves	246ADI, 246DRF	E85	no		
Morrison Bros	Tank gauge	618	UN	no		
Morrison Bros	Tank Monitor Adaptor and Cap	305XPA	E85	no		
Morrison Bros	Vapor Recovery Adaptor	323	E85	no		EVR CARBa
Morrison Bros	Vapor Recovery Caps	323C	E85	no		
Morrison Bros	Vent-double outlet (small UST)	155	E85	no		
Morrison Bros	Vent-double outlet (small UST)	155S, 155FA	UN	no		
Morrison Bros	Vent-pressure vacuum	548, 748, 749	E85	no		
Morrison Bros	Vent-updraft	354	E85	no		
Morrison Bros	Vent-updraft	354T	UN	no		
Morrison Bros		571, 571P	UN	no		
National Environmental Fiberglass	Sumps-tank	All	E85	yes	no	EVR CARB
National Environmental Fiberglass	Sumps-transition	All	E85	yes	no	EVR CARB
National Environmental Fiberglass	Sumps-dispenser	All	E85	yes	no	EVR CARB

Company	Product	Model	E%	UL Listed	UL listed for this fuel	Other Approval
Above Ground Equipment						
OPW	Balance Adaptor	28CS	E25	no		
OPW	Breakaway	66V-0492	E85	yes	yes	
OPW	Breakaway	66V-030RF	E25	yes	yes	
OPW	Breakaway	66V-0300, 66RB-2000, 68EZR-7575, 66REC-1000, 66SB-7575, 66SB-1010, 66CAS-0300, 66ISU-5100, 66ISB-5100, MFVA, 66CLP-5100, 66CSU-5200	E10	yes	yes	
OPW	nozzle	21GE-0992	E85	yes	yes	
OPW	Nozzle	11AP-0100-E25, 11AP-0300-E25, 11AP-0400-E25, 11AP-0900-E25, 11BP-0100-E25, 11BP-0300-E25, 11BP-0400-E25, 11BP-0900-E25	E25	yes	yes	
OPW	Nozzle	11AP / 11BP Series	E10	yes	yes	
OPW	Swivel	241TPS-75RF	E25	yes	yes	
OPW	Swivel	36S series, 241TPS series, 20S series, 45 series	E10	yes	yes	
OPW	Swivel	241TPS-0492	E85	yes	yes	
OPW	Emergency shear valve	10 series	E100	yes	no	
OPW	Vapor shear valve	60VS	E100	yes	no	EVR CARBa
AST Equipment						
OPW	AST anti-siphon valve	199ASV	E85	yes	no	
OPW	AST ball valve	21BV SS	E85	yes	no	
OPW	AST check valve	175, 1175	E85	no	no	
OPW	Drop tube	61FT	E25	no	no	EVR CARBa
OPW	AST emergency shut off valve	178S	E85	no	no	
OPW	AST emergency vent	201, 202	E85	yes	no	
OPW	AST emergency vent	301	E86	yes	no	EVR CARBa
OPW	AST mechanical gauge	200TG	E85	yes	no	EVR CARBa
OPW	AST overfill prevention valve	61fSTOP A or M versions	E85	yes	no	EVR CARBa
OPW	AST overfill prevention valve	61ƒSTOP	E25	yes	no	
OPW	AST pressure vacuum vent	523V, 623V	E100	yes	no	
OPW	AST solenoid valve	821	E25	yes	no	
OPW	AST spill container	211-RMOT, 331, 332	E85	yes (ulc	no	EVR CARBa
OPW	AST swing check valve	all	E85	no	no	
OPW	AST tank alarm	444TA	E85	no (ETL	no	
OPW	AST vapor adaptor	1611AVB-1625	E85	no		
OPW	AST vapor cap	1711T-7085-EVR, 1711LPC-0300	E85	no		

Company	Product	Model	E%	UL Listed	UL listed for this fuel	Other Approval
UST Equipment						
		Caps and adaptors				
OPW	Fill adaptor-top	633T, 633TC	?	yes	no	
OPW	Fill-swivel adaptor	61SALP-MA, 61SALP-1020-EVR	E85	yes	no	CARB EVR
OPW	Vapor swivel adaptor	61VSA	?	yes	no	CARB EVRa
OPW	Fill-swivel adaptor (vapor)	61VSA-MA, 61VSA-1020-EVR	E85	yes	no	CARB EVR
OPW	Fill cap-side	62TT	?	yes	no	
OPW	Fill adaptor-side	61AS	?	yes	no	
OPW	Vapor adaptor	1611AV, 1611AVB	E100	yes	no	CARB EVR
OPW	Vapor Cap	1711T	E85	yes	no	CARB EVR
OPW	Monitoring well probe cap	62M, 116M	E100	yes	no	
OPW	Monitoring well probe cap	62M-MA	E85	yes	no	CARB EVR
OPW	Monitoring well cap kit	634TTM, 62PMC	?	yes	no	
OPW	Monitoring test well	61SPVC	?	no		
		Extractors, Manholes, Multi-ports				
OPW	Extractor fittings and plug	233, 233VP	E85	no		CARB EVR
OPW	Multi-port spill containment	411, 511, 521, Fiberlite,	E100	no		CARB EVR
OPW	Jack screw	71JSK	E85	no		
OPW	Jack screw	61JSK	?	no		
OPW	Face seal adaptor (threaded riser adaptor)	FSA-400	?	no		CARB EVR
OPW	Manhole	Conquistador, Fiberlite, 104AOW-1200, 104C,	?	no		
		Overfill Prevention				
OPW	Overfill prevention valve	61SOM-412C-EVR, 61SOCM-4000, 71SO, 71SO-T, 71SOM	E85	no		CARB EVR
OPW	Overfill prevention valve	61SOC-4001, 61SOC-4011, 61SOP-4002, 61SOP-4012	E10	no		
OPW	Float kit	61SOK-0001	E10	no		
OPW	Ball float vent valve	21BV, 53VML, 30MV	E85	no		
OPW	Drop tube	61T, 61TC, 61TCP	E10	no		
OPW	Drop tube	61TSS	E85	no		CARB EVR
OPW	Spill container (bucket)	1-2100, 1SC-2100, EDGE	E100	yes	no	CARB EVRa
OPW	Spill container (bucket)	1-2105, 1-2200, 101-BG2100	E100	yes	no	
OPW	Tank bottom protectors	6111, 61TP	E10	no		
		Check Valve, Flexible Connectors, Vents				
OPW	Flexible connectors	All	E100	yes	no	SA
OPW	Check valve	70, 70S	E85	yes	no	
OPW	Pressure vacuum vent	523V, 623V	E85	yes	no	
OPW	Pressure vacuum vent	23	?	yes		
OPW	Vent	514, 515	?	?		
		Sumps				
OPW	Dispenser sumps	FlexWorks	E85	yes	no	
OPW	Tank sumps	Fiberlite, FlexWorks	E85	yes	no	
OPW	Transition sumps	FlexWorks	E85	yes	no	
OPW	Sump accessories	FlexWorks	E85	yes	no	

Manufacturer	Product	Model	E%	UL Listed	UL listed for this fuel	Other Approval
Petroleum Containment	Sump-dispenser	CLE, DCL, EZ-PLUMB, MVR	?	no		
Petroleum Containment	Sump-tank	4200	E100	no		
Petroleum Containment	Sump-transition	all	?	no		
Pneumercator	Magnetostrictive probe	MP450S, MP451S, MP452S, MP461S, MP462S, MP463S, MP464S MP550S, MP551S, MP552S, MP561S, MP562S, MP563S, MP564S	E100	yes	no	
Pneumercator	Leak sensors	ES825-100F, ES825-100XF,ES825-100CF, ES825-200F, ES825-200XF ES825-300F, ES825-300XF,ES825-300CF, ES825-400F, ES825-400XF HS100D, HS100ND LS600LD, LS600S, LS610 RSU800-2, RSU801F, RSU810	E100	yes	no	
Pneumercator	Single/Multi-Point Level Sensors	LS600, LS600F4, LS600M, LS600W, LS600X	E100	yes	no	
Pneumercator	Mechanical Gauges	DR-1-10, P5, P14	E100	no	no	
S. Bravo Systems	Fiberglass Fittings	Series F, FF, FPE, FR, Retrofit-S, D-BLR-S, D-INR-S, FLX, FLX-INR, FPS, TBF	E100	yes	no	
S. Bravo Systems	Spill Buckets	B3XX	E100	yes	no	
S. Bravo Systems	Tank Sumps & Covers	B4XX	E100	yes	no	
S. Bravo Systems	Transition Sumps	B5XX, B6XX, B7XX, B8XX	E100	yes	no	
S. Bravo Systems	Under Dispenser Containment Sumps	B1XXX, 7XXX, B8XXX, B9XXX	E100	yes	no	
Vaporless Manufacturing	Leak detector	99LD-2000/2200/3000 without stainless steel tubing/fittings	E20	yes	no	
Vaporless Manufacturing	Leak detector	99LD-2000/2200/3000 with stainless steel tubing/fittings	E100	yes	no	
Vaporless Manufacturing	Overfill prevention valve	OPF-2/3 without stainless steeltubing/fittings	E20	yes	no	
Vaporless Manufacturing	Overfill prevention valve	OPF-2/3 with stainless steel tubing/fittings	E100	yes	no	

Manufacturer	Product	Model	E%	UL Listed	UL listed for this fuel	Other Approval
Veeder-Root	AST probe	Mag-FLEX	E15	yes	no	
Veeder-Root	Float kit	846400	E15	yes	no	
Veeder-Root	Magnostrictive probes	Mag Plus Probe for Alternative Fluids with Water Detection P/N 846391-1xx or -2xx, Inventory Only Mag Plus Probe for Alternative Fluids with Water Detection P/N 846391-3xx	E20	yes	no	
Veeder-Root	Magnostrictive probes	Mag Plus Probe for Alternative Fluids without Water Detection P/N 846391-4xx or -5xx, Mag Plus Probe for Alternative Fluids without Water Detection P/N 846391-6xx	E100	yes	no	
Veeder-Root	Magnostrictive probes	Mag-D Density Probe, MagPlus Leak Detection Probe, MagPlus Inventory Measuremeant Probe	E15	yes	no	
Veeder-Root	Mechanical line leak detect	Red Jacket FXV	E100	yes	no	
Veeder-Root	Phase separation float	Phase-2	E15	yes	no	
Veeder-Root	Sensor-dispenser and sump	Discriminating and Non Discriminating Dispenser Pans and Containment Sensors, Sump sensor (piping), Mag Sump Sensor, Stand-alone Dispenser Pan Sensor	E15	yes	no	
Veeder-Root	Sensor-dispenser and sump	Position Sensitive Interstitial Sensor	E85	yes	no	
Veeder-Root	Sensor-groundwater	Groundwater Sensor	E15	yes	no	
Veeder-Root	Sensor-tank	Discriminating Interstitial Sensor Double Wall Fiberglass, Interstitial Sensors for Fiberglass Tanks, Intersitial Sensors for Steel Tanks	E15	yes	no	
Veeder-Root	Sensor-tank	Discriminating Interstitial Sensor Double Wall Fiberglass, Interstitial Sensors for Fiberglass Tanks-High Alcohol, Interstitsial Sensors for Steel Tanks-High Alcohol, MicroSensor (steel tanks, fill riser)	E85	yes	no	
Veeder-Root	Sensor-vapor	Vapor Sensor	E15	yes	no	
Western Fiberglass	Co-Flex piping	all	E100	yes	no	
Western Fiberglass	Cuff fittings	all	E100	no		
Western Fiberglass	Sumps (tank, dispenser, transition, vapor, vent)	all	E100	yes	no	
Western Fiberglass	Co-flow hydrostatic Monitoring systems	all	E100	no		

Appendix F. Methods to Identify Underground Storage Tanks

http://www.steeltank.com/Portals/0/TTNewsletter/September2012/TankTalk_September2012.pdf

Steel Tank Institute

Tank Talk, September 2012

Identifying Buried Fuel Storage Tanks

by Bert Schutza, Tanknology, with contributions from Danny Brevard, ACCENT

How to identify the construction of your buried fuel storage tank when original purchase documents are missing – a guidance tool offering some simple suggestions.

More than one method is often required to make conclusions specific to tank type:

1. Stick your tank to determine the tank diameter. Certain diameters of tanks between 6,000-gallon to 15,000-gallon capacity are indicative of steel tanks and some of the fiberglass reinforced plastic (FRP) tanks. 92" diameter tanks, for example, are almost always FRP, while 96" diameter tanks are normally steel.
   a. Tank Diameter Measurement: Measure from bottom of tank to top of riser and then subtract the length of the riser.
2. Knowing the date of installation is a great tool for figuring out what type of steel tank you might have. This chart gives you important dates in the history of steel tank technology development:

Finding a label is very helpful!

Date	Event	Tank Type
1969	Sti-P3 technology created	Cathodically Protected
1984	STI Dual Wall Tank Standard published	
1987	Original Association for Composite Tanks was formed	Composite
1990	First STI standard for ACT-100 developed	Composite
1992	STI adopted the Permatank technology	Jacketed
1996	ACT-100-U created	Coated

3. Is your tank single wall or double wall? Double wall tanks will have an interstitial monitoring opening, which is often a 2" fitting. Double wall steel tanks have an access port directly down to the bottom of the steel tank, usually at the end of the tank. Some steel tanks, most often jacketed tanks, have a 2" interstitial riser pipe down through the inside of the tank, with tanks constructed since 1998 with the pipe in the longitudinal center of the tank. FRP tanks will usually have an access riser that goes down the tank top, and then circles the annular space around the tank. Some double wall FRP tanks have a liquid reservoir at the tank top, and the interstice is full of brine solution.

Liquid reservoir

944 Donata Ct. Lake Zurich IL 60047 847-438-8265 info@steeltank.com ©STI/SPFA 2011

Appendix G. Pipe Dope Diagram

This diagram shows areas at a refueling station where pipe dope/pipe thread sealant might be used.

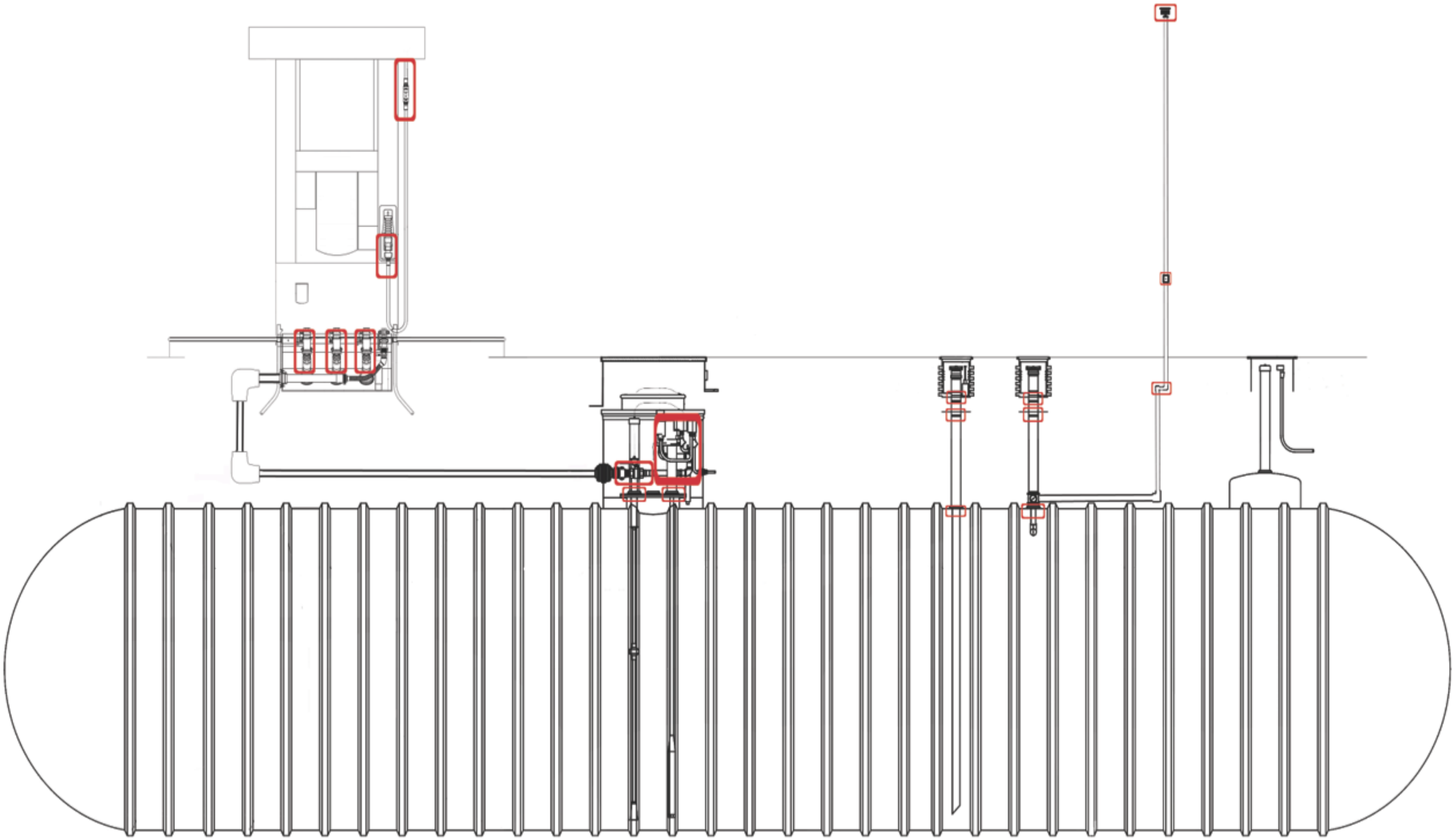


Diagram provided by Source North America, a fueling equipment distributor

RENEWABLE
FUELS
ASSOCIATION

ATTACHMENT 4

Analysis of Whether the Prices of Renewable Fuel Standard RINs Have Affected Retail Gasoline Prices

informa economics

A Whitepaper
Prepared for the Renewable Fuels Association
May 2015

Key Findings

- Changes in prices of renewable identification numbers (RINs) did not cause changes in retail gasoline prices from 2013 through the first quarter of 2015.
- Retail gasoline prices were driven primarily by movements in crude oil prices and secondarily by changes in the spread between domestic and international crude oil prices and the level of vehicle miles driven in the U.S., which varies seasonally.

Background and Introduction

The Energy Policy Act of 2005 created a Renewable Fuel Standard, which requires gasoline sold in the U.S. to contain at least certain minimum volumes of biofuel. Two years later, the Energy Independence and Security Act of 2007 significantly expanded the previous targets, and the revised Renewable Fuel Standard (known as RFS2) was allocated among specific categories of renewable fuels.

A system of renewable identification numbers was designed by the EPA for compliance with RFS2. A RIN is a 38-digit code representing a specific volume of renewable fuel. RINs are generated by a producer or importer of renewable fuel. Once the fuel is blended, the separated RINs can be used by obligated parties (mainly refiners) for compliance purposes, held in inventory for future compliance, or traded among companies.

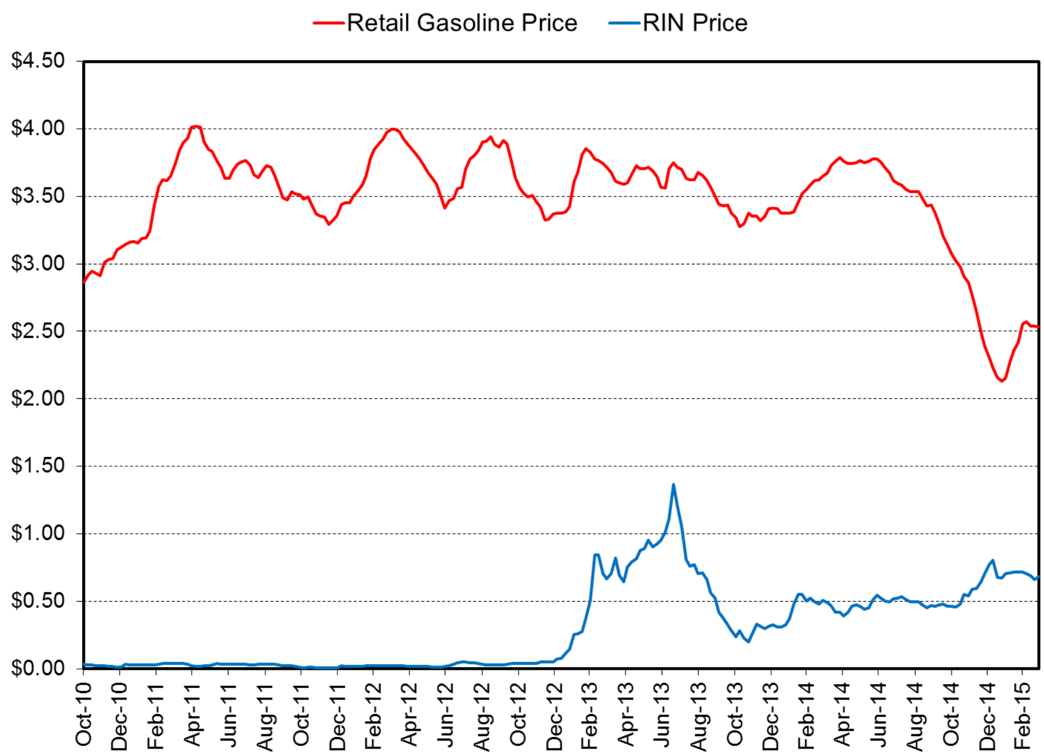
Market participants began to realize in early 2013 that ethanol usage could fall well short of levels needed to meet RFS2 going forward, and prices of conventional ethanol RINs (known as "D6" RINs) rose to levels that were multiples of any that had been experienced previously, spiking to nearly $1.50 during July 2013. This was in part a result of the 2012 drought, which reduced the size of the corn crop and led to record-high prices and the idling of ethanol plants in late 2012 and early 2013, as market prices for ethanol were not sufficient to allow producers to offset higher production costs and sustain significantly positive margins. However, RIN prices dropped precipitously during the late summer and early fall of 2013.

In November 2013, the EPA proposed substantial cuts to the volumes associated with all RFS2 standards except the one for biomass-based diesel. The general structure of the proposal had become known to industry and the press in advance of the official release. RIN prices also reached a bottom that month. The EPA proposal was withdrawn in late 2014, and as of this writing the RFS2 volume requirements for 2014 and 2015 have not been issued.

Conventional ethanol RIN prices rebounded to $0.50 by February 2014, and they traded in a range of roughly $0.45-0.55 through November. In late 2014, RIN prices moved higher, and mid-January through the end of the first quarter of 2015 they centered around $0.70.

On the other hand, gasoline prices fell by one-third between the week of July 4, 2014, and the end of the first quarter of 2015 (Exhibit 1). This was driven by a substantial drop in oil prices.

Exhibit 1: Weekly Retail Gasoline and Conventional Ethanol (D6) RIN Prices



Sources: DOE-EIA (Gasoline Prices), OPIS (RIN Prices)

Some commentators have speculated that RIN prices might have driven retail gasoline prices higher. While such speculation has ebbed since the RIN price spike of mid-2013, such allegations still are in the public discourse from time to time. During and shortly after the initial price spike, difficulties in conducting near-real-time analysis were compounded by limited historical data, as RINs for the different categories of biofuels under RFS2 had only traded since 2010, and for much of their history conventional ethanol (D6) RINs had traded at very low prices.

Now that additional time has passed, the Renewable Fuels Association ("RFA") commissioned Informa Economics, Inc. ("Informa") to conduct an analysis of whether the RIN prices changes have been driving gasoline prices for U.S. consumers, or if not, to determine the main factors that actually have caused retail gasoline price changes.

Informa conducted its analysis in two phases. First, Informa used a statistical method to determine whether changes in RIN prices “caused” (i.e., were a significant driver of) changes in retail gasoline prices. Second, a streamlined statistical regression “explaining” gasoline price movements was developed. If the first phase concluded that changes in RIN prices have “caused” changes in gasoline prices, a determination would be made as to whether RIN prices were a statistically significant explanatory variable to be included in the regression developed during the second phase.

Causality Analysis

In order to test whether or not changes in RIN prices “caused” changes in retail gasoline prices, a statistical method called a Granger causality analysis was utilized. Weekly average RIN prices reported by OPIS for the period spanning from October 29, 2010, to March 27, 2015, were paired with weekly average retail gasoline prices reported by EIA for the same time period. Prior to use in the Granger models, the data were differenced, and thus, the resulting models were built using the weekly change in RIN prices compared to the weekly change in gasoline prices.

Of primary interest was the question: Did changes in RIN prices cause gasoline prices to change? In the past, the discussion centered around whether higher RIN prices caused higher retail gasoline prices. However, as can be seen in Exhibit 1, retail gasoline prices have fallen dramatically since the summer of 2014, whereas RIN prices were relatively steady through the summer and fall of 2014 before moving to a moderately higher plateau.

To test the question of causation, a two-stage process was utilized. First, an initial model was developed that specified the current change in gasoline price as a function of the previous week’s change in the price of gasoline. Next, a secondary model was constructed identical to the first, except that the previous week’s change in the RIN value was added as an explanatory variable.

The idea behind the Granger causality analysis is simple: If the second model (containing the lagged RIN variable) is superior to the initial model, then this means that the previous week’s RIN price has some explanatory power relative to the current week’s gasoline price. If this is found to be the case, then it can be asserted that gasoline price changes are “caused” to some extent by changes in the RIN price. The term “caused” is used loosely here, since it does not imply that the RIN price was the only factor affecting gasoline prices. In the context of this analysis, the term “caused” would simply refer to the presence of some connection between the change in the RIN price and subsequent changes in gasoline prices.

To determine if one model is superior to another, it is appropriate to look at the size of the error terms associated with each model (i.e., the difference between the actual prices observed and the prices that would have been predicted by the model). If the errors from one model are significantly smaller than those of the other, this implies that the model has superior predictive power, and thus, is a better representation of reality.

Granger causality analysis compares the sum of squared errors associated with the model containing the RIN variable with same statistic for the model that does not contain the RIN variable. Exhibit 2 provides the results of the Granger causality analysis. The P-values reported in the table measure the probability that the errors from the unrestricted model (the one containing RIN values) are the same as the errors from the restricted model (no RIN value). There is an 89% probability these model errors are not significantly different, leading to the conclusion that changes in RIN prices do not appear to cause changes in gasoline prices.

Exhibit 2: Results of the Granger Causality Test

	---- P Values -----
RIN Price Causes Gas Price	**0.886**
Gas Price Causes RIN Price	**0.289**
	---- Significant at 5% Level? -----
RIN Price Causes Gas Price	**N**
Gas Price Causes RIN Price	**N**

P-values are the probability that the sum of squared errors in the unrestricted model is not different from the sum of squared errors in the restricted model.

It is worth noting that as an auxiliary part of this analysis, a second set of models was prepared that reversed the flow of causality, in order to examine whether or not changes in the gasoline price caused changes in RIN values. In the reverse case, there is a 29% probability that there is no difference between the models, and though this is much lower than for the RIN-to-gasoline case – implying that there is a higher probability from a statistical perspective that changes in gasoline prices “caused” changes in RIN prices – this is not considered strong enough to make this conclusion.

In summary, the evidence from the Granger causality work leads to the conclusion that changes in RIN prices have not caused changes in retail gasoline prices (or vice-versa). To any extent that the two are related, it is not a direct causal relationship.

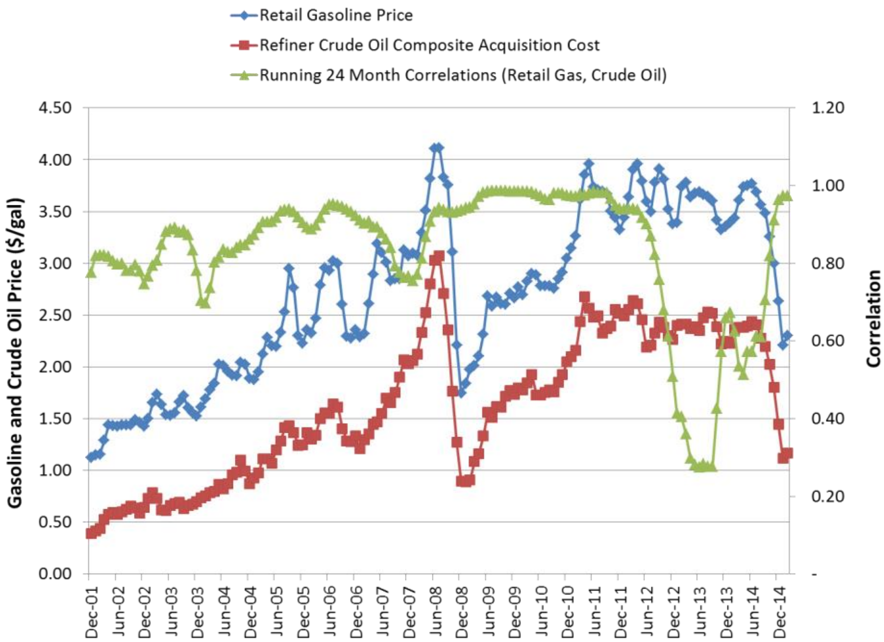
Gasoline Price Drivers

Given the results of the analysis above, a second question naturally arises: What does drive retail gasoline prices? Accordingly, the second phase of the analysis examines the key factors that do “explain” retail gasoline price movements. It should be remembered that RINs were created only in the aftermath of the establishment of the Renewable Fuel Standard in 2005, and the differentiation of RINs by biofuel category did not take effect until 2010, whereas gasoline prices have been volatile for decades.

The primary driver of retail gasoline prices is crude oil prices, as crude oil is the primary input in gasoline production. Historically, the running 24-month correlation between crude oil[1] and retail gasoline prices has generally been between 0.80 and 0.99, which indicates a very strong relationship, given that a coefficient of 1.00 would indicate perfect positive correlation (Exhibit 3).

Exhibit 3: Monthly Retail Gasoline and Crude Oil Price Relationship

(December 2001 – March 2015)



Sources: EIA (Prices); Informa Economics (Analysis)

This relationship began to show signs of weakening starting in the spring of 2012. One of the key factors behind the weakening has been the divergence between international and domestic crude oil prices and the heightened volatility of the spread between these prices[2]. This divergence was mainly attributable to growing crude oil stocks at inland locations – especially the delivery point for NYMEX crude oil futures at Cushing, Oklahoma – as a result of a combination of increased domestic oil production from shale plays such as North Dakota's Bakken formation and lagging infrastructure construction to move the oil to consumption centers. The oil-price spread narrowed throughout 2013 and 2014, as infrastructure came come online to facilitate movements of crude to the Gulf Coast, but it has remained volatile into 2015.

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[1] For each month illustrated in Exhibit 3, the correlation between crude oil and retail gasoline prices during the previous 24 months was examined. Refinery composite crude oil acquisition cost data was utilized to represent crude oil costs for U.S. refineries, as this reflects a weighted U.S. average of imported and domestic crude oil used to produce gasoline.

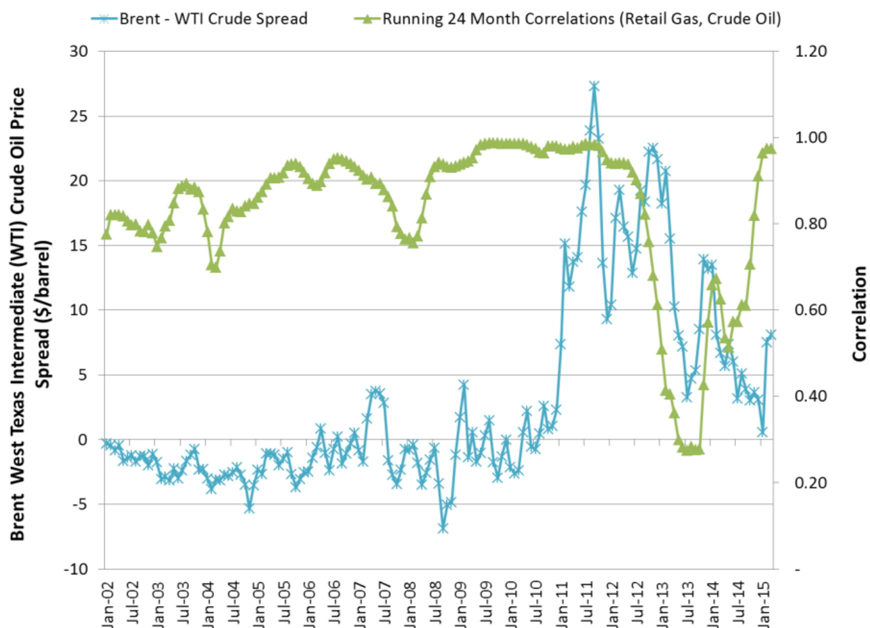
[2] Brent crude oil prices were utilized to represent prices in the international market, and WTI prices were utilized to represent prices in the domestic market.

Another relatively recent development is that the U.S. has emerged as an exporter of gasoline. Brent crude oil serves as an international benchmark and influences the pricing of gasoline in international markets. Consequently, the wide and volatile spread between Brent crude oil prices and U.S. oil prices has also added a layer of complexity to U.S. gasoline-pricing dynamics.

As illustrated within Exhibit 4, the weakening price relationship between crude oil and retail gasoline price followed the growing spread between U.S. West Texas Intermediate (WTI) and Brent crude oil prices[3]. It is also notable that this weakening price relationship preceded the increase in RIN prices that occurred starting in early 2013.

Exhibit 4: Monthly Brent-to-WTI Crude Oil Price Spread vs. Retail Gasoline and Crude Oil Price Correlation

(January 2002 – March 2015)



Sources: EIA (Prices); Informa Economics (Analysis)

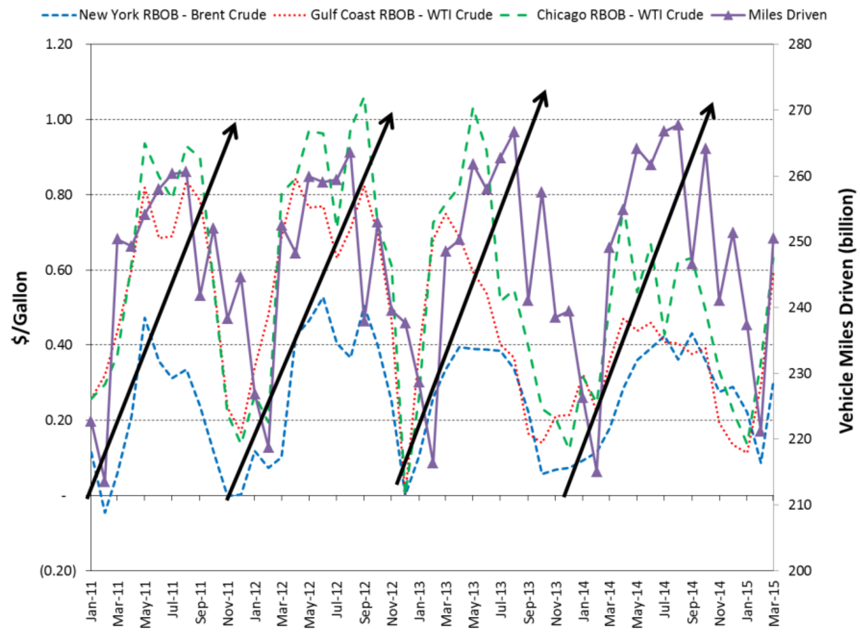
Another factor affecting retail gasoline prices is seasonal demand. There is a distinct seasonal pattern to gasoline prices and crack spreads (i.e., the margins refiners earn by processing crude oil into transportation fuels, in this case gasoline). Gasoline prices and crack spreads tend to slump during the last quarter of the calendar year, particularly November and December, and then strengthen considerably through the first quarter of the year and remain strong through the summertime driving season (see Exhibit 5). A

[3] It is notable that the chart uses a 24-month correlation, and thus there is a lag between when the Brent-WTI price spread begins to expand and when the correlation between crude oil and retail gasoline prices appears to weaken in the chart.

key factor behind this trend is the increase in vehicle miles driven during the summer months, which is anticipated by the markets and prepared for by refiners.

Exhibit 5: Seasonal Crack Spreads and Vehicle Miles Driven

(January 2002 – March 2015)



Sources: EIA (crude oil prices), OPIS (RBOB prices), U.S. Department of Transportation (miles driven), and Informa Economics (analysis)

The relative role of each of the above factors in "explaining" movements in retail gasoline prices was estimated econometrically[4], and results are presented in Exhibit 6. A majority of gasoline price movements can be explained by crude oil prices. A $0.10/gallon increase in crude oil prices ($4.20/barrel) has resulted in a roughly $0.10/gallon increase in retail gasoline prices, all else being held equal. In the model, variables for the Brent-WTI crude oil price spread and vehicle miles driven were also statistically significant, and they improved model performance somewhat. Together these variables explain 95% of the historical retail gasoline price movements (as indicated by the adjusted R-squared statistic).

[4] Monthly data from April 2008 – March 2015 was utilized within this regression.

Exhibit 6: Retail Gas Price Model

Dependent Variable = U.S. Retail Gasoline Price

Explanatory Variable	Coefficient	Statistically Significant at 5% Level
Intercept	0.0616957	
Refiner Crude Oil Composite Acquisition Cost	1.02258	Yes
Brent - WTI Crude Oil Price Spread	0.010008	Yes
Vehicle Miles Driven	3.88184 * 10^6	Yes

Adjusted R-Squared = .95

Source: Informa Economics

Conclusions

Based on statistical analysis, it can be concluded that changes in RIN prices did not "cause" the changes that occurred in retail gasoline prices in 2013, and this has continued to be the case through the first quarter of 2015.