

Report No. SR2010-08-01

# **Identification and Review of State/Federal Legislative and Regulatory Changes Required for the Introduction of New Transportation Fuels**

prepared for:

**American Petroleum Institute**

August 4, 2010

prepared by:

Sierra Research, Inc.  
1801 J Street  
Sacramento, California 95811  
(916) 444-6666

**Report No. SR2010-08-01**

**Identification and Review of  
State/Federal Legislative and Regulatory Changes Required  
for the Introduction of New Transportation Fuels**

prepared for:

American Petroleum Institute

August 4, 2010

Principal authors:

James M. Lyons  
Allan G. Daly  
Lori Williams  
Ed Gardetto  
Dennis McClement

Sierra Research, Inc.  
1801 J Street  
Sacramento, CA 95811  
(916) 444-6666

# **Identification and Review of State/Federal Legislative and Regulatory Changes Required for the Introduction of New Transportation Fuels**

## Table of Contents

	<u>Page</u>
1. Executive Summary .....	1
2. Introduction .....	4
3. Federal Fuels Requirements .....	6
3.1 Requirements that New Transportation Fuels be “Substantially Similar” to Existing Fuels .....	6
3.2 Fuel Registration and Health Effects Requirements .....	7
3.3 Fuel Rating and Labeling Requirements .....	9
3.4 Gasoline Detergent Certification Requirements .....	10
3.5 E10+ Volatility Exemption .....	11
3.6 RFG Requirements .....	11
4. State Fuels Requirements .....	14
4.1 ASTM and NIST Specifications .....	15
4.2 Blending Restrictions and Blending Caps .....	17
4.3 Waivers from Gasoline Vapor Pressure Requirements .....	18
4.4 T50 Minimum Offsets and Vapor Lock Protection (T@V/L=20) Offsets .....	19
4.5 California .....	19
4.6 State Implementation Plans .....	22
4.7 Summary of Changes to State Requirements .....	22
5. Vehicle and Engine Warranties .....	27
5.1 Light-Duty Gasoline Vehicles .....	27
5.2 Other Gasoline-Fueled Equipment .....	30
5.3 Diesel Vehicle/Engine Warranties and Biodiesel Blends .....	30
6. Fuel Storage, Marketing, and Distribution .....	32
6.1 Pipelines and Terminals .....	32
6.2 Requirements for Retail Fuel Outlets .....	33
6.3 Changes in Pump Labeling .....	35

Appendix A – Summary of Changes Required in Order for E15 and Other New  
Transportation Fuels to be Introduced into Commerce

Appendix B – Regulatory Applicability Matrix for E10+ and Biodiesel

## List of Figures

<u>Figure</u>	<u>Page</u>
Figure 1-1 Generic Schematic of the Process for Introduction of New Transportation Fuels .....	3
Figure 3-1 Current Federal RFG Areas .....	12
Figure 4-1 States/Areas Adopting ASTM D4814.....	16
Figure 4-2 States Limiting Gasoline-Ethanol Blends to 10% by Volume.....	17
Figure 4-3 States with Specific Gasoline-Ethanol Blend Vapor Pressure Waivers.....	18
Figure 4-4 States with Minimum T50 Allowances Tied to E10.....	20
Figure 4-5 States With Vapor Lock Protection Allowances Tied to E10.....	20
Figure 4-6 Nonattainment and Maintenance Areas in the U.S. 8-Hour Ozone (1997 Standard).....	23
Figure 6-1 States Requiring Label Changes for E10+ .....	36

## List of Tables

<u>Table</u>	<u>Page</u>
Table 4-1 Summary of Identified State Changes Required for E10+ .....	23
Table 4-2 Summary of Identified State Changes Required for Biodiesel .....	25
Table 5-1 Manufacturer Limits on Allowable Ethanol Content in Conventional Vehicles .....	28
Table 5-2 Manufacturer Limits on Biodiesel Blends for Existing Vehicles and Engines .....	31

## **1. EXECUTIVE SUMMARY**

In order to expand the use of renewable fuels in the transportation sector, Congress passed the Energy Policy Act (EPACT) of 2005, which required the establishment of Renewable Fuel Standards (commonly referred to “RFS1”). In December 2007, Congress passed the Energy Independence and Security Act of 2007 (EISA), which further increased the volumes of renewable fuels required under the RFS (commonly referred to as “RFS2”) and required EPA to promulgate consistent regulations by December 2008. More specifically, the RFS2 mandated by EISA requires that annual renewable fuel use in the transportation sector be at least 15.2 billion gallons in 2012 and at least 36 billion gallons by 2022.

In 2010, the U.S. Environmental Protection Agency (EPA) promulgated the RFS2 regulations required by EISA and set the effective date as July 1, with retroactive application of the entire rule to January 1, and also combined the 2009 and 2010 biomass-based Diesel requirement. Although the means by which compliance with the long-term requirements of the RFS2 will ultimately be achieved are not clear, it is expected that they will include, among other options, expanded use of E85 and the use of new transportation fuels, including mid-level gasoline-ethanol blends with maximum ethanol volumes in the range of 15 to 20% (E10+) by volume and potentially other alcohols and ethers, as well as higher-level blends of biodiesel and renewable Diesel fuels.

Given this, it is important to recognize that the introduction of new transportation fuels into the marketplace is not simple or straightforward. Using the introduction of E10+ as an example, the widespread introduction of this fuel will require the following:

1. A waiver of Clean Air Act pre-emption under Section 211(f);
2. Registration of the fuel with EPA;
3. Changes to EPA Reformulated Gasoline regulations;
4. Changes to EPA Gasoline Detergent Additive regulations;
5. Changes to the Clean Air Act and EPA regulations if the Reid Vapor Pressure (RVP) Allowance granted to E10 is going to be provided to E10+ blends;
6. Changes to federal fuel rating and labeling requirements;

7. Changes to ASTM and NIST specifications for commercial fuels;
8. Changes to a myriad of state fuel requirements, with the number and nature of those changes varying from state to state; and
9. Changes in equipment and operating practices in the gasoline transportation and distribution system, including pipelines, storage tanks, and retail dispensing facilities.

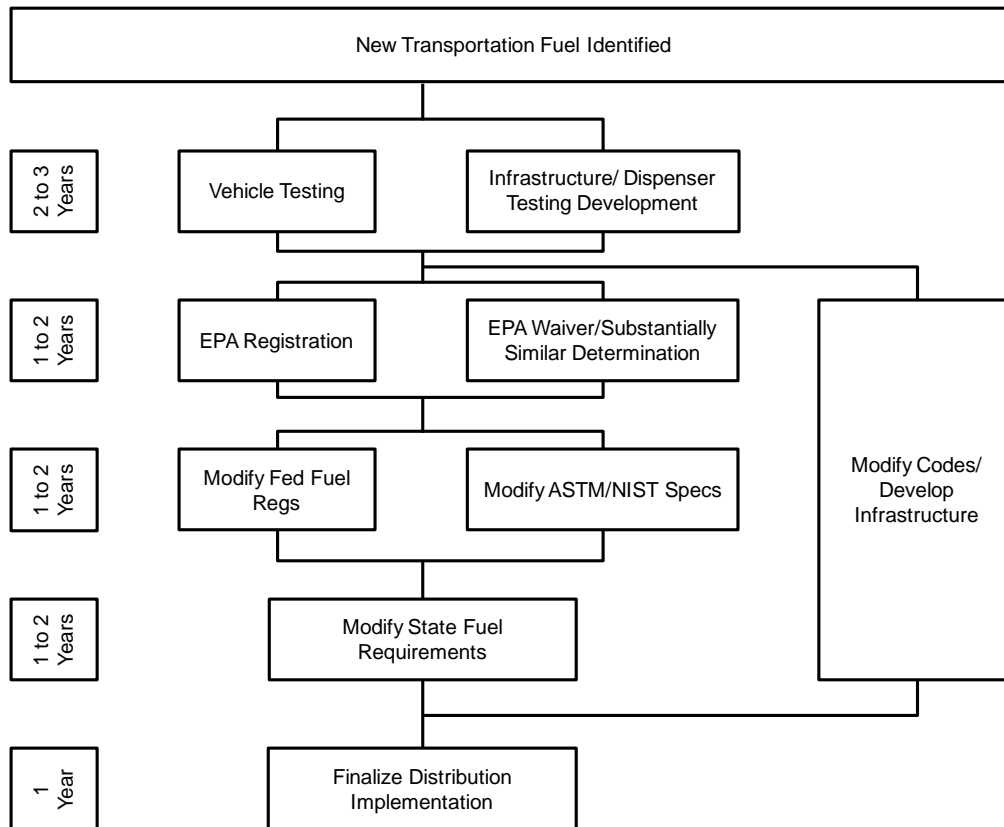
Many of these changes must occur prior to the initial sale of a new transportation fuel, while a few can be subsequently addressed. The period of time estimated to be required for the completion of all of the above changes is on the order of several years.

In addition to the changes described above, there are concerns regarding the performance of existing vehicles and engines on E10+ and issues associated with the fact that manufacturer warranties for these productions do not specifically indicate that operation on E10+ is acceptable.

In general, all new transportation fuels will face similar hurdles to commercial introduction. The generic process for introduction of a new transportation fuel is shown schematically in Figure 1-1. As shown, the first steps in the process following identification of the fuel involve testing in existing vehicles and engines and testing of the fuel related to fuel distribution system, both of which are required to understand the impacts of the new fuel. Using the data from that process, the next steps involve EPA's either approving the fuel as being "substantially similar" to gasoline or Diesel fuel or granting a waiver, and the registration of the fuel pursuant to EPA regulations. At about this time, changes that are required to building codes and infrastructure will have to be considered, developed, and implemented.

Once EPA approval of the new transportation fuel is complete, changes may be required to fuel specifications published by ASTM and NIST which are used to ensure that commercial fuels have consistent properties and are of acceptable quality. In some cases, new ASTM and NIST specifications may be needed. In addition, changes to federal regulations like those described above for E10+ may be required. Because many states adopt ASTM and/or NIST specifications in ways that are linked to state laws and regulations or have their own fuel specifications, changes to all of these will also have to be made. Finally, after the above steps are completed, any remaining issues will have to be resolved before the fuel enters into commerce. While it is difficult to estimate the exact time required for the above process to be completed, as it will vary depending on the nature of the fuel in question, it is clearly on the order of years, with a reasonable estimate being about five years.

**Figure 1-1**  
**Generic Schematic of the Process for Introduction of New Transportation Fuels**



###

## 2. INTRODUCTION

In order to expand the use of renewable fuels in the transportation sector, Congress passed the Energy Policy Act (EPACT) of 2005, which required the establishment of Renewable Fuel Standards (commonly referred to “RFS1”). In December 2007, Congress passed the Energy Independence and Security Act of 2007 (EISA), which further increased the volumes of renewable fuels required under the RFS (commonly referred to as “RFS2”). More specifically, the RFS2 mandated by EISA requires that annual renewable fuel use in the transportation sector be at least 15.2 billion gallons in 2012 and at least 36 billion gallons by 2022.

In March 2010, the U.S. Environmental Protection Agency (EPA) promulgated the RFS2 regulations required by EISA. The means by which compliance with the long-term requirements of the RFS2 will ultimately be achieved are not clear; however, it is expected that they will include, among other options, expanded use of E85 and the use of new transportation fuels, including mid-level gasoline-ethanol blends with maximum ethanol volumes in the range of 15 to 20% (E10+) by volume and potentially other alcohols and ethers, as well as higher-level blends of biodiesel and renewable Diesel fuels.

With respect to E10+, in March 2009, Growth Energy filed an application for a Clean Air Act Waiver of the Section 211(f) for ethanol-gasoline blends containing 15% ethanol by volume (E15). As is well known, the current limit of 10% by volume for low gasoline-ethanol blends restricts the use of ethanol to volumes well below those likely to be required for compliance with the RFS2. In November 2009, EPA responded to Growth Energy that it did not have sufficient information to grant the waiver and that, pending the successful completion of additional testing, the agency expected to be in a position to approve the waiver request by the middle of 2010. EPA subsequently indicated\* that the decision on the waiver for 2007 and later model year vehicles could be made by the end of September 2010 and that a decision on 2001 to 2006 model-year vehicles could be made in November 2010. The agency has also indicated that if it issues a waiver for one or both groups of vehicles, it plans to propose regulations to prevent the misfueling of vehicles and engines with E10+ along with modifications to existing federal regulations governing the properties of reformulated (RFG) and conventional gasoline.

---

\* <http://www.epa.gov/otaq/regs/fuels/additive/e15status-updated.htm>



As evidenced by its announced regulatory plans,<sup>\*</sup> EPA has recognized that approval of the Growth Energy waiver request will not, in and of itself, allow for the entry of E15 or other E10+ blends into commerce without changes to current regulations. However, the changes proposed by EPA represent only a small portion of the legislative, regulatory, and administrative changes that states, regions, and localities across the country will be required to make in order for E15, higher E10+ blends, and other new transportation fuels, including biodiesel blends, to become commercially viable. In addition, the introduction of new transportation fuels into commerce will raise a host of other issues related to the compatibility of those fuels with vehicles, engines, and the country's fuel distribution and marketing infrastructure.

More specifically, the issues that will need to be addressed beyond revised federal regulations include the following:

- Changes to state and local legislation and regulations regarding fuel properties, ASTM, and NIST specifications;
- Changes to state implementation plans for attainment of National Ambient Air Quality Standards; and
- Changes to requirements for gasoline dispensing facilities and equipment.

It should also be noted that fuel requirements are in place in most states, but can differ markedly from state to state. Further, in some cases, fuel requirements have been established at the regional or local level. In addition to the need for changes to existing requirements, the introduction of new transportation fuels poses issues associated with fuel storage and distribution equipment, as well as new vehicle and engine warranties for both on- and non-road applications and the potential for liability related to damage or destruction of existing on- and non-road engines.

Given the above, Sierra Research has, at the request of the American Petroleum Institute, conducted an independent review of existing federal, state and other statutes, regulations, and requirements that must be changed and other significant implementation hurdles that must be overcome prior to the introduction of E15 and other new transportation fuels into commerce. Sierra was assisted in this effort by the firm Herman and Associates of Washington, D.C., which provided access to the firm's extensive database of federal and state legislation and regulatory motor fuel laws and regulations,<sup>†</sup> as well as regulatory support and assistance.

###

---

<sup>\*</sup> U.S. EPA February 2010 Action Initiation List, corrected as of 3/22/2010.

<sup>†</sup> Herman and Associates' U.S. Motor Fuel Regulatory and Legislative Compliance Service, Washington, D.C., [www.HermanAssociates.com](http://www.HermanAssociates.com)

### 3. FEDERAL FUELS REQUIREMENTS

As noted in the previous section, EPA has indicated that it plans to propose changes to existing federal regulations governing the properties of reformulated and conventional gasoline to accommodate ethanol-gasoline blend fuels up to at least E15, and will promulgate new regulations to prevent the misfueling of vehicles and engines with E10+ blends. However, as described below, there are additional changes to federal regulations that will be required in order for E15 to be introduced on a widespread basis, and more general federal fuel requirements that have to be satisfied before other new transportation fuels could be introduced.

#### 3.1 Requirements that New Transportation Fuels be “Substantially Similar” to Existing Fuels

Sections 211(f)(1)(A) and (B) of the Clean Air Act prohibit the introduction into commerce, or increases in the concentration in use of, fuels and fuel additives that are not “substantially similar” to fuels or fuel additives used in the certification of 1975 or subsequent model-year vehicles. Section 211(f)(1)(A) established this prohibition effective March 31, 1977, for fuels used in light-duty motor vehicles; Section 221(f)(1)(B) established this prohibition for motor vehicles effective November 15, 1990.

At present, EPA defines\* fuels and fuel additives that meet criteria that include the following as “substantially similar” with respect to Section 211(f)(1)(A):

1. The fuel must contain carbon, hydrogen, and oxygen, nitrogen, and/or sulfur, exclusively, in the form of some combination of the following:
  - a. hydrocarbons;
  - b. aliphatic ethers;
  - c. aliphatic alcohols other than methanol;
  - d. (i) up to 0.3 percent methanol by volume;  
(ii) up to 2.75 percent methanol by volume with an equal volume of butanol, or higher molecular weight alcohol;
  - e. a fuel additive at a concentration of no more than 0.25 percent by weight which contributes no more than 15 ppm sulfur by weight to the fuel.

---

\* <http://www.epa.gov/otaq/regs/fuels/additive/jan91.pdf>

2. The fuel must contain no more than 2.0 percent oxygen by weight, except fuels containing aliphatic ethers and/or alcohols (excluding methanol) must contain no more than 2.7 percent oxygen by weight.
3. The fuel must possess, at the time of manufacture, all of the physical and chemical characteristics of an unleaded gasoline as specified in ASTM Standard D 4814-88 for at least one of the Seasonal and Geographical Volatility Classes specified in the standard.
4. The fuel additive must contain only carbon, hydrogen, and any one or all of the following elements: oxygen, nitrogen, and/or sulfur.

Absent a finding that a fuel is substantially similar, manufacturers of fuels or fuel additives may apply for a waiver of the provisions of Section 211(f)(1)(A) and (B) if EPA determines that the fuel or fuel additive "...will not cause or contribute to a failure of any emission control device or system...." EPA has interpreted the waiver provisions in Section 211(f)(4) as requiring that applicants must bear the burden of demonstrating that their fuel additive complies with the "cause or contribute" test for all regulated pollutants.

As noted above, Growth Energy has filed a waiver application for E15 because E10+ blends do not conform to EPA's "substantially similar" definition and EPA approval of that application will require a finding that E15 passes the "cause or contribute" test. Other new renewable transportation fuels—including blends of higher molecular weight aliphatic alcohols such as butanol with gasoline—would have to either conform to the EPA definition of "substantially similar" or be granted a Section 211(f) waiver in order to be introduced into commerce. In addition, it is possible that renewable fuels intended to be used in Diesel-powered vehicles could require 211(f) waivers in order to be introduced into commerce.

Section 211(f)(4) specifies that EPA must grant or deny a waiver application within 270 days of receipt. At the end of 2009, the Administrator sent Growth Energy a letter stating that EPA was deferring action on the E15 waiver. To date, well over a year has passed since its initial submission. Obviously, the process of generating and gathering the data needed to support a waiver application also requires considerable time to complete.

### 3.2 Fuel Registration and Health Effects Requirements

Part 79, Title 40 Code of Federal Regulations addresses requirements for the "Registration of Fuels and Fuel Additives" (F&FA). These regulations specify that any manufacturer of a motor vehicle gasoline or Diesel fuel, or an additive for use in gasoline or Diesel fuel, must register with the agency prior to the introduction into commerce of the fuel or fuel additive. On May 27, 1994, pursuant to sections 211(b)(2) and 211(e) of the Clean Air Act (CAA), EPA promulgated a rule adding health effects information and

testing requirements to the agency's existing registration program for motor vehicle fuels and fuel additives. Only gasoline and Diesel fuel and fuel additives produced and commercially distributed for use in highway motor vehicles are designated for the registration and testing program. Fuels intended for use in exclusively off-road vehicles are not currently designated. Since the regulations apply only to gasoline and Diesel fuel, fuels that fall outside of those definitions, E85 for example, are not subject to the EPA fuel registration requirements.

Under EPA's F&FA registration requirements, each manufacturer is required to submit basic registration data individually for each product being registered. Basic information required for F&FA registration includes product and manufacturer identification, concentration and purpose, in-use and specific compositional data, total annual production volume data, marketing distribution data, notification about group participation, and notification on the use of special provisions. This part of the registration process is straightforward and requires little time to complete.

However, in addition to the basic registration data listed above, EPA also requires that fuels and fuel additives must meet Tier 1 and Tier 2 requirements in order to complete registration. Tier 3 provides for additional testing on a case-by-case basis, at EPA's discretion, in response to Tier 1 or Tier 2 results or future needs.

As part of the requirements of Tier 1, F&FA manufacturers are required to perform a literature search on the health and welfare effects of their F&FA product(s); generate, collect, and sample the combustion emissions and, if applicable, the evaporative emissions of their F&FAs; and conduct tests to determine the identity and concentration of individual emission products. Tier 2 consists of testing requirements designed to detect potential adverse health effects related to the inhalation of F&FA emissions. These requirements generally involve the generation of emissions from a vehicle or engine in a laboratory setting, exposure of laboratory test animals to these whole emissions, and evaluation of the effects of this exposure. Manufacturers of similar F&FAs are permitted to group together and share the costs of compliance. Special provisions are also included for small businesses. Tier 2 testing is very extensive and involved and can take years to complete.

When Tier 1 and Tier 2 are complete, manufacturers are requested to submit the results to EPA for evaluation. On the basis of the submitted data or any other available information, EPA will determine whether further testing and/or analysis for the subject F&FA is needed under the provisions of Tier 3. Any confirmatory studies to be conducted in Tier 3 will be determined individually for each case, generally focusing on areas of concern identified in the earlier tiers.

For products considered to be new and dissimilar to current F&FAs, all testing requirements must be completed prior to registration and introduction into commerce, including Tier 3 when prescribed by EPA.

E15 and other mid-level ethanol blends must be registered with EPA and meet applicable EPA registration and health effects testing provisions before being sold into commerce. Ethanol at 10 volume percent is the only ethanol additive currently registered by EPA. While it is anticipated that no statutory or regulatory change would be required, E10+ blends would need to complete applicable registration and health effects testing requirements before being able to be marketed.

EPA has registered B100 as a motor vehicle Diesel fuel; therefore, lower concentrations of B100 would not require additional health effects testing. Further, EPA's position is that all possible blends of biodiesel are currently compliant by virtue of the registration of B100. Renewable Diesel has also satisfied EPA Tier 1 and Tier 2 health effects testing requirements and a number of companies have registered renewable Diesel with EPA.

Other new renewable transportation fuels would also be required to be registered pursuant to Part 79. As outlined above, the requirements for registration and therefore the time required to obtain registration can vary, but could require as much as several years.

### 3.3 Fuel Rating and Labeling Requirements

Part 306 of Title 16, Code of Federal Regulations sets forth requirements for gasoline and Diesel fuel ratings and labeling administered by the Federal Trade Commission. Existing regulations set requirements for gasoline-ethanol blends up to E10, defined as gasoline, and fuels with at least 70 percent ethanol, but do not specifically address blends between E10 and E70. However, the FTC has initiated a rulemaking\* that includes proposed retail labeling requirements for E10+ blends. The proposal, if enacted, would require either identification of the precise concentration of ethanol in the blend or disclosure of the range of ethanol in the blends being dispensed. In addition, the proposal would change labeling requirements for all ethanol-gasoline blends to warn that blends with more than 10 percent ethanol may harm some conventional vehicles. Although this rulemaking is already underway, it could take up to a year to complete.

Modifications to FTC labeling requirements and/or fuel rating requirements could be necessary to allow for the introduction other new transportation fuels into commerce.

In addition to the FTC rulemaking regarding labeling for E10+ blends, EPA, in response to the Growth Energy petition for a section 211(f) waiver, has indicated that it is considering a "partial waiver" that would allow E15 use in 2001 and later model-year vehicles and suggested that misfueling of other vehicles and equipment with E10+ could be prevented by federal regulations requiring labeling of pumps dispensing E10+. It is not clear from the EPA letter if this is a reference to the FTC rulemaking or if EPA is proposing to undertake a separate effort. If EPA decides to undertake its own effort with respect to labeling, it would likely require at least a year to complete. Further, to the extent that EPA, other regulatory agencies, or fuel providers conclude that more

---

\* Federal Register, Vol. 75, No 50, 12470, March 16, 2010.

aggressive measures are needed to prevent misfueling with E15 substantial additional time, effort, and expense could be required. For example, a recent study<sup>\*</sup> examined 17 options, other than pump labeling, that could reduce the incidence of both unintentional and intentional misfueling, and, in general, found that the most effective measures were costly and required fundamental changes in current vehicle refueling practices. Implementation of such measures via regulation would require several years for the development and promulgation of regulations as well as the actual implementation of the program. Voluntary introduction of such measures would likely require a similar amount of time.

Another area where changes to existing labeling and warning practices performed pursuant to federal regulations may be required in order to allow for the introduction of new transportation fuels is with respect to the Material Data Safety Sheet requirements found in Section 1200 of Part 1910, Title 29, Code of Federal Regulations.

### 3.4 Gasoline Detergent Certification Requirements

Section 211(l) of the Clean Air Act mandated that EPA adopt regulations requiring the use of additives in gasoline to prevent the accumulation of deposits in engines or fuel supply systems. The regulations promulgated by EPA for deposit control are set forth in Subpart F of Part 80, Title 40 Code of Federal Regulations. Section 80.163 specifies the types of detergent certification options and Section 80.164 specifies the certification test fuels required for use in demonstrating the effectiveness of detergents. Generic certifications and certifications for use in premium gasoline currently require the use of certification fuels containing 10% ethanol by volume. Options for oxygenate type specific certification require the presence of those specific oxygenates in the certification fuels.

Because all existing detergent certifications were performed using certification fuels containing no more than 10% ethanol, there is no means to ensure that gasoline using those additives at their currently allowed concentration levels will continue to conform to the gasoline detergency requirements. Therefore, changes to the EPA gasoline detergency regulations will be required to ensure that additives are effective when used with E10+ blends in preventing deposit accumulation. Key issues associated with the changes to these regulations will be the level of ethanol required in the certification fuels as well as whether generic certifications will be appropriate for all types of oxygenates that may be considered for commercialization given the requirements of the RFS2 regulations. It is also possible that existing certified additives may not be compatible with non-oxygenated renewable fuels that are developed for use in gasoline-powered vehicles. In this case, additional changes to the gasoline detergency regulations could be required.

---

<sup>\*</sup> "Evaluation of Measures to Mitigate Misfueling of Mid- to High-Ethanol Blend Fuels at Fuel Dispensing Facilities," Gilson Environmental, April 19, 2010.

The time required to modify the gasoline detergency requirements is likely to be on the order of one to two years (the Clean Air Act amendments of 1990 provided two years for the development of the original regulations). Following that, another substantial period of time will be required for additive certification.

### 3.5 E10+ Volatility Exemption

Because the addition of ethanol to a gasoline blendstock results in an increase in the front-end volatility of the blend relative to neat gasoline, a one psi RVP exemption for gasoline-ethanol blends sold during summer months in non-RFG areas was provided for in Section 211(h)(4) of the Clean Air Act and is reflected in Section 80.27(d) Title 40 Code of Federal Regulations (40 CFR). This provision was primarily intended to allow for the splash blending of ethanol into both finished gasolines as well as gasoline blendstocks. Given that there is an increase in RVP with E10+ blends in the E15 to E20 range, extending the RVP exemption to E10+ would facilitate its widespread introduction into commerce. However, Section 80.27(d) makes it clear that the EPA RVP exemption during the period when EPA RVP requirements are in effect is limited to gasoline-ethanol containing between 9 and 10% ethanol by volume.

While an RVP exemption for E10+ blends is not mandatory from a strictly technical perspective, it is likely to be so from the perspective of widespread commercialization. Without the RVP exemption, fuel producers would be forced to either reduce the RVP of gasoline blend stocks they provide in an area so that E10+ complies without the RVP exemption or produce special low RVP blend stocks for use with E10+ blends.

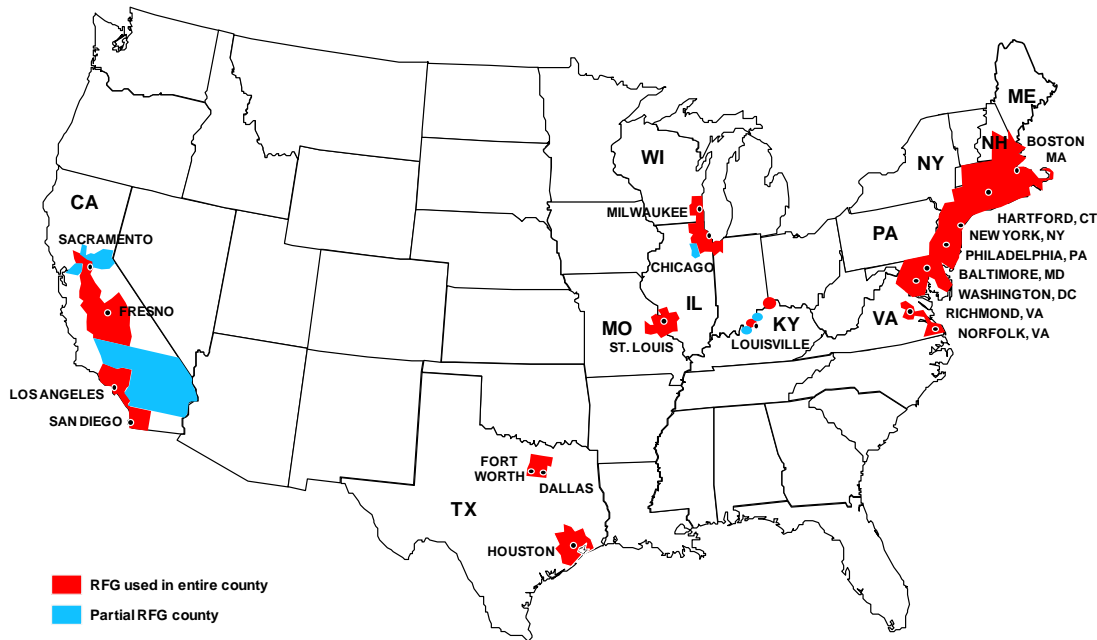
In order to provide an RVP exemption for E10+ blends in conventional gasoline, EPA would have to complete a rulemaking to modify Section 80.27(d). In order for this to be accomplished, a modification of Section 211(h)(4) of the Clean Air Act would likely be required to extend the RVP exemption to E10+ blends. The time required for EPA to complete a rulemaking would likely depend on the comments received, with a conservative estimate being six to twelve months. It is much more difficult to estimate the amount of time that would be required for Congressional action to modify Section 211(h)(4).

The federal RVP exemption is not an issue with respect to RFG areas because the applicable federal regulations would subject E10+ blends to the same VOC control requirements that apply to other RFG blends, including E10.

### 3.6 RFG Requirements

The first federal RFG requirements took effect in 1995, with Phase II beginning in 2000. Figure 3-1 depicts the areas where federal RFG is currently required; as shown, these areas include most of the northern Atlantic seaboard; most of California; as well as the Chicago-Milwaukee, St. Louis, Dallas-Fort Worth, and Houston areas.

**Figure 3-1**  
**Current Federal RFG Areas**



According to the U.S. Energy Information Administration,\* in 2009 RFG accounted for approximately 35% of total U.S. gasoline sales. Therefore, any bar to the use of E10+ blends in RFG areas will have a significant impact on the amount of ethanol that can be consumed in the U.S. even if EPA grants the Growth Energy waiver.

EPA regulations regarding RFG and the related Anti-Dumping regulations are found in Subparts D and E of Part 80, Title 40 Code of Federal Regulations. RFG is certified via the Phase II Complex Model pursuant to 40 CFR Sections 80.41(e) and (f) and used in determining compliance with Anti-Dumping requirements of Subpart E. In addition, the Complex Model will continue to be used by small refiners exempted through 2015 from the provisions of 40 CFR Section 80.1220, who will still be required to comply with the toxics provisions of 40 CFR Section 80.825.

One question regarding the changes required to RFG requirements to accommodate E10+ is whether changes to the Complex Model will be required. The Complex Model was created in the early 1990s by applying statistical methods to a large database of vehicle emission test results obtained on a wide range of gasolines and was incorporated into the RFG regulations when they were promulgated in 1994. The Complex Model estimates the impacts of changes in eight specific gasoline properties relative to a 1990 baseline gasoline on emissions of vehicles representative of 1990 model-year emission control

\* [http://www.eia.doe.gov/dnav/pet/pet\\_cons\\_refmg\\_d\\_nus\\_VTR\\_mgalpd\\_a.htm](http://www.eia.doe.gov/dnav/pet/pet_cons_refmg_d_nus_VTR_mgalpd_a.htm)



technologies. The range of allowable values for these gasoline properties over which the currently applicable Phase 2 Complex Model is deemed by EPA to be valid is set forth in 40 CFR 80.45(f). With respect to oxygenate content, the maximum limit is 4.0 percent by weight (approximately E11.5). Given this, EPA will have to modify the RFG regulations to accommodate E15 and most E10+ blends.

Under the existing EPA RFG regulations, the process for augmenting the Phase 2 Complex Model to accommodate the higher oxygen levels associated with E10+ is specified in 40 CFR 80.48 through 80.62. These sections specify that the model is to be augmented with emissions data obtained from testing various fuels in vehicles representative of 1990 model-year emission control technologies. At this point in time, it is highly unlikely, however, that this process would be used to accommodate E10+ blends in the RFG regulations.

In addition to the above, the Energy Policy Act of 2005 included the addition of Section 211(q)(2), which specifies that EPA was to develop, by August 8, 2009, an "...emissions model that reflects to the maximum extent practicable, the effects of gasoline characteristics or components on emissions from vehicles in the motor vehicle fleet during calendar year 2007." The model required by Section 211(q)(2) has not been published by EPA, but could presumably be structured such that it addresses the emissions impacts of oxygen content that characterize E10+ blends. Presumably, this new model would also account for permeation emissions associated with the use of gasoline-ethanol blends. While EPA is currently collecting vehicle emission test data that could be used to create this model, it is not clear that Congress intended for it to be used to modify or replace the Phase 2 Complex Model in the RFG program.

The time required to revise the RFG regulations will depend directly on the need to conduct vehicle testing programs beyond those that have already been completed or are underway in order to generate data required to characterize the impacts of gasoline composition, including E10+, on vehicles representative of the 2007 calendar year fleets. Once sufficient emissions testing data are available, a period of between six months to a year would likely be required to develop an updated version of the Complex Model, and another six months to a year would be required for EPA to promulgate the necessary changes to Subparts D and E of Part 80.

EPA has indicated that it will issue a notice of proposed rulemaking to address E10+ and the Complex Model within the next nine months.

###

## **4. STATE FUELS REQUIREMENTS**

In addition to federal fuel requirements, most states and some regions and localities impose their own requirements on transportation fuels. Given this, Sierra reviewed current state fuels requirements and identified the changes that would be needed to those requirements to allow for the commercial introduction of E10+ blends and the expanded use of biodiesel blends, including the introduction of blends above B20 but below B100, and other new transportation fuels. This review, which included all 50 states and the District of Columbia, was facilitated by access to the Herman and Associates federal and state legislative and regulatory motor fuel database.

This review found that many states have adopted ASTM specifications for gasoline (D4814), Diesel fuel (D975), biodiesel blends (D7467), and biodiesel blend stocks (D6751) or specifications established by National Conference on Weights and Measures (NCWM) under the National Institute of Standards and Technology (NIST), and have provided relief from certain provisions of those specifications for ethanol blends. Issues related to ASTM and NIST specifications and new transportation fuels are discussed below. Many states also have enacted legislation or regulations that establish a volumetric cap on the amounts of ethanol or biodiesel that can be used in fuel blends as well as limit state RVP or other volatility allowances for gasoline-ethanol blends to 10 volume percent ethanol.

Additional issues exist for those states with areas that are in nonattainment with respect to compliance with federal National Ambient Air Quality Standards (NAAQS). The first of these is that the RVP exemptions discussed above will have been included in the State Implementation Plans (SIPs) approved by EPA for those areas. Therefore, unless Congress extends the RVP waiver to E10+ blends, changes related to those exemptions will require SIP changes. In addition, and perhaps more important, is the impact of new transportation fuels on emissions from the vehicles and engines that operate on them. To the extent that the introduction of a new transportation fuel leads to changes in emissions-related fuel regulations or increases in pollutant emissions, SIPs for those areas may need to be modified, but not necessarily before a new transportation fuel could be marketed. These issues are also discussed below.

In addition, the specific changes that Sierra identified as being necessary for the commercialization of E10+ and the expanded use of biodiesel and other new

transportation fuels are presented by state in Appendix A of this report, along with estimates of the time required to implement those changes.\*

It should also be noted that while Sierra has attempted to produce the most accurate summary possible, there are constant changes being made to laws, regulations, and standards governing motor vehicle fuels. Additionally, there is a vast body of interpretive policies and enforcement procedures adopted by regulating entities that are related to the issues discussed below.

#### 4.1 ASTM and NIST Specifications

Current ASTM and NIST standards for gasoline and low-level gasoline-ethanol blends were not intended to apply to E10+ fuels. Certain states adopting ASTM requirements, notably California,<sup>†</sup> take the position that the current ASTM standard does not apply to E10+ blends, which would render them illegal for sale in those states. While the scope of the ASTM D4814 specification does apply to ethanol blends higher than E10, the current lower T50 limit applies only to blends containing from 1 to 10 percent ethanol by volume. In addition, it would be unlikely that E10+ blends could meet the T50 limits of the current version of the ASTM D4814 specification without modification,<sup>‡</sup> and data would be required to support modifications to the specifications. The reference to EPA waivers for ethanol blends in D4814 would need to be updated if and when EPA makes changes to those provisions. The time required to change ASTM D4814 to accommodate E10+ is unknown, but would be at least six months.

As shown in Figure 4-1, most states in the country currently adopt some form of ASTM D4814, but states vary widely as to which version of ASTM 4814 they adopt—certain states adopt the most recent version of D4814, others adopt a specific year designation or the version contained in a designated ASTM Annual Book of Standards, and others may use D4814 as a guideline in establishing state fuel quality specifications. Even those states that adopt the most recent version of ASTM differ on whether they interpret their rules to mean the “latest version” contained in the ASTM Book of Standards or the latest version of ASTM D4814 posted on the ASTM website. In all cases for states adopting the ASTM D4814, the issue of whether E10+ blends are allowed or prohibited presents a serious issue with respect to their introduction, even if EPA grants the Growth Energy waiver request.

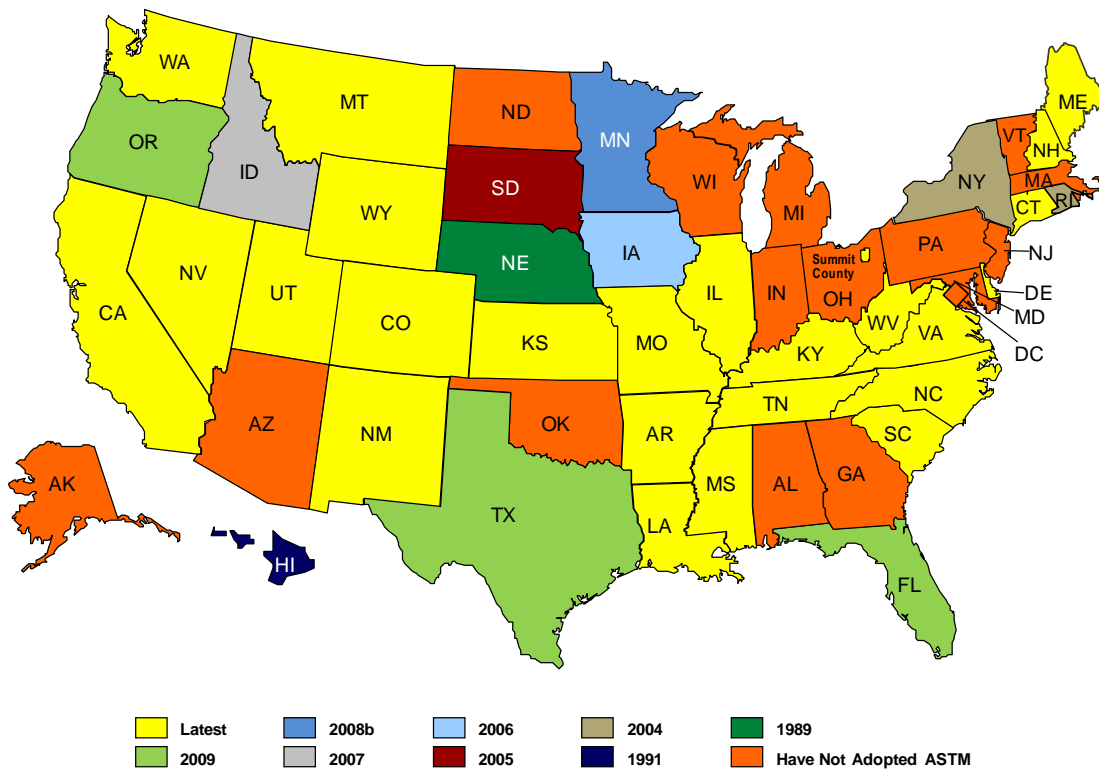
---

\* The time estimates are based, where possible, on direct communications with state representatives and on estimates from Sierra Research and/or Herman and Associates where state-specific information was not available.

<sup>†</sup> See <http://www.calepa.ca.gov/biofuels/>

<sup>‡</sup> “Determination of the Potential Property Ranges of Mid-Level Ethanol Blends,” American Petroleum Institute, April 23, 2010.

**Figure 4-1**  
**States/Areas Adopting ASTM D4814**



In addition to ASTM specifications, the 2010 version of NIST Handbook 130 limits volatility allowances for ethanol blends to only gasoline containing from 1 to 10% ethanol by volume. Therefore, for those states that have adopted the current version of the uniform regulation in NIST Handbook 130 by reference, E10+ blends would not qualify for the designated volatility allowances without legislative or regulatory action. Where states have adopted specific, pre-2010 versions of NIST Handbook 130, providing several blending options for ethanol, it is ambiguous as to whether changes are required to accommodate E10+ blends.

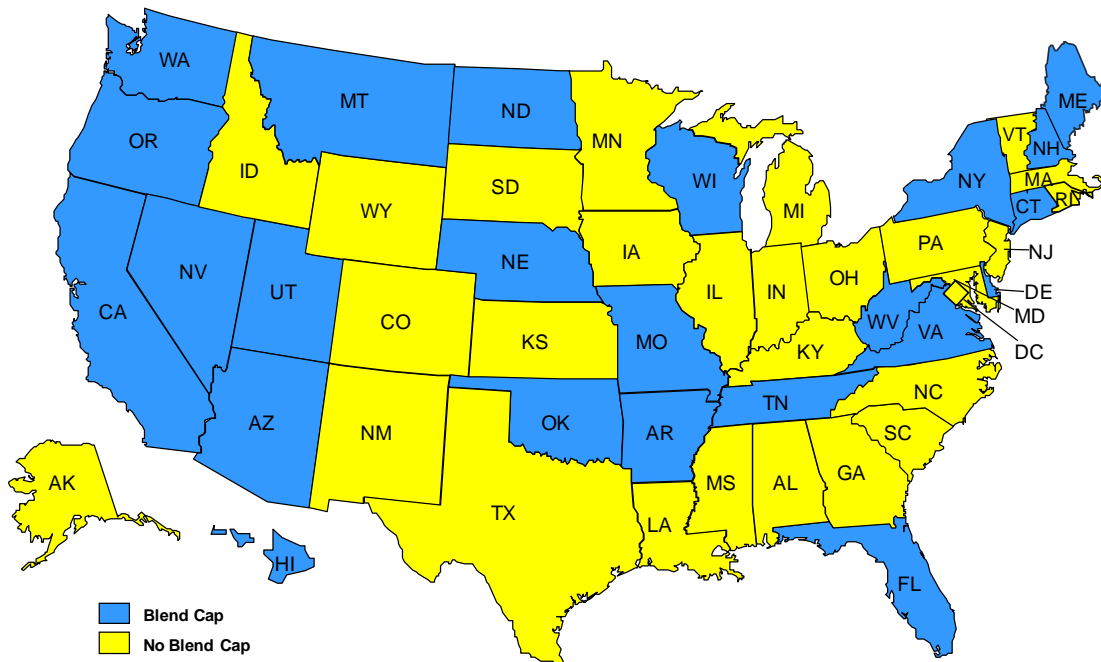
With respect to biodiesel, the ASTM specification for Diesel fuel (D975) provides for blends of up to B5 while the specification for biodiesel blends (D7467) provides for blends from B5+ to B20 provided that the biodiesel blend stocks conform to the appropriate ASTM specification (D6751), which also applies to B100. There is no current ASTM specification that applies to biodiesel blends in the B20+ to B99 range. Given the above, there are a number of states that enforce ASTM D975, which effectively caps biodiesel blends at B5; and others that enforce ASTM D7467, effectively precluding biodiesel blends in the B20+ to B99 range, despite EPA's position that such blends comply with federal requirements.

## 4.2 Blending Restrictions and Blending Caps

As noted above, the 2010 edition of NIST Handbook 130 creates a blending cap at E10. For states adopting the most recent version of NIST Handbook 130, introduction of E10+ would require either a change in state legislation or regulations to permit E10+ or a modification by the National Conference on Weights and Measures to the E10 blending cap in the 2010 edition of NIST Handbook 130. In addition, E10 blending caps in state fuel specifications, state biofuel mandates, and tax incentives for renewable fuels specify specific concentrations of ethanol or biodiesel required to comply with the mandate and/or qualify for state tax incentives. States that have adopted ethanol mandates have generally specified E10 as part of the mandate, effectively creating a blending cap. In some states, there are other statutory and/or regulatory requirements that create blending restrictions and caps.

States where Sierra has identified E10 blending caps are shown in Figure 4-2. The identified source of each blend cap in each state is specified in Appendix A. As shown, E10 blend caps that would have to be addressed through state action in order to allow the introduction of E10+ currently exist in a substantial number of states. Although not shown in Figure 4-2, a number of states also have biodiesel blend caps; these are specified in Appendix A and in the summary tables presented later in this section.

**Figure 4-2**  
**States Limiting Gasoline-Ethanol Blends to 10% by Volume**

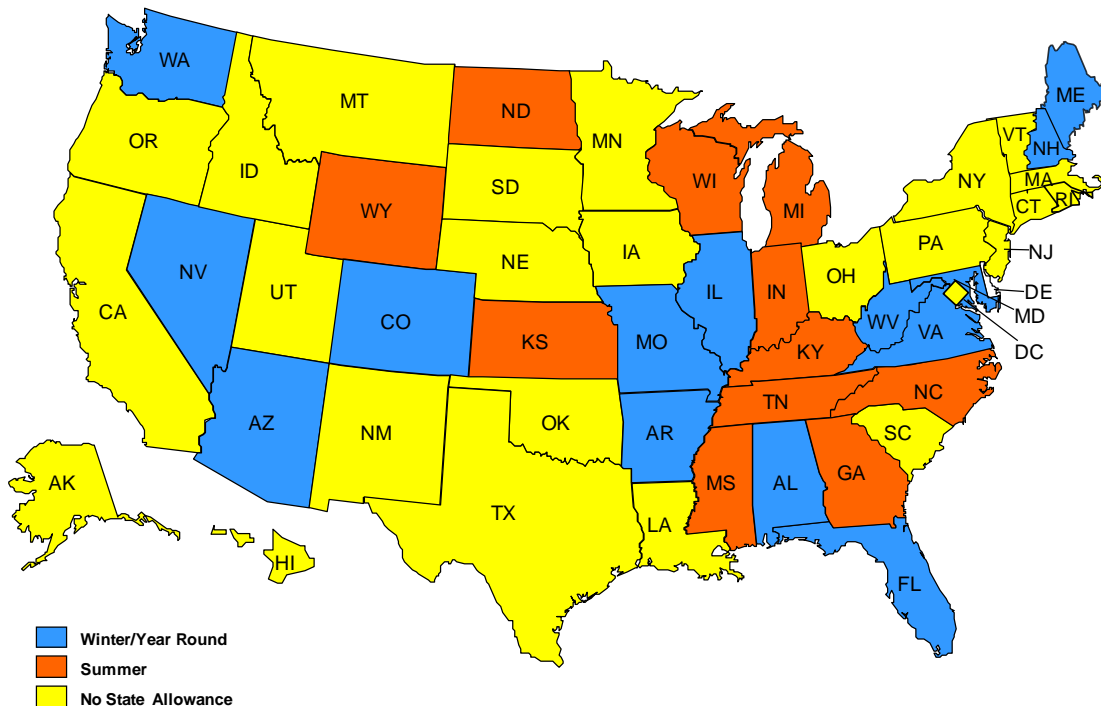


### 4.3 Waivers from Gasoline Vapor Pressure Requirements

As is well known, in addition to the federal RVP exemption for E10, many states have adopted gasoline volatility limits either by adopting ASTM D4814 or NIST Handbook 130, or by establishing state vapor pressure limits.

States identified as establishing a state RVP waiver tied directly to an E10 limit are shown in Figure 4-3. As shown in Figure 4-3 and in Appendix A and Table 4-1, there are two types of RVP waivers: the first of these is similar to the waiver provided by EPA for summer RVP under Section 80.27; the second is more general and provides for exemptions for specific ethanol gasoline blends during non-summer months or on a year-round basis. In most cases, RVP waivers are limited on the upper end at E10 limits. As with blend caps, the number of states where changes would have to be made to expand RVP waivers to E10+ is large.

**Figure 4-3**  
**States with Specific Gasoline-Ethanol Blend Vapor Pressure Waivers**



The specific source of each limit that would have to be modified in each state is listed in Appendix A. Section 2.1.3 of the current version (2010 amendment) of NIST Handbook 130 also allows a 1.0 psi vapor pressure offset from ASTM D4814 for gasoline-ethanol

blends containing 9 to 10% ethanol by volume in the summer and for blends of 1 to 10 volume percent ethanol during the remainder of the year. If a state has adopted the current version of NIST Handbook 130, it was determined that a legislative or regulatory change would be necessary. Where states have adopted specific, pre-2010 versions of NIST Handbook 130, providing several blending options for ethanol, it is ambiguous as to whether changes would be required to accommodate E10. For states that have developed independent volatility standards, a case-by-case determination was made as to whether the state standards limit ethanol blending. However, if the state provided a vapor pressure offset or exemption to lower ethanol blends, it was determined that a regulatory change was necessary to extend the offset or exemption to E10+ blends. Such action, however, would be dependent on EPA issuing a waiver for E10+ blends.

#### 4.4 T50 Minimum Offsets and Vapor Lock Protection (T@V/L=20) Offsets

In addition to blend caps and vapor pressure waivers, many states have also adopted their own allowances for offsets for T50 minimum distillation temperatures and vapor lock protection that apply to ethanol blends either by adopting ASTM D4814 or NIST Handbook 130, or by establishing allowances independently through legislation and/or regulation.\* In many cases, these allowances are limited to blends of or up to E10 and changes would be required in order for them to apply to E10+ blends.

States where such provisions apply are highlighted in Figures 4-4 and 4-5 and, again, the specifics related to each state are given in Appendix A. While less numerous than states with E10 blend caps or vapor pressure allowances tied to E10, provisions related to T50 minimum and vapor lock protection tied to E10 are common and would have to be changed to apply to E10+ blends.

#### 4.5 California

The State of California imposes fuel requirements beyond those discussed above that warrant specific discussion given the magnitudes of the changes that will be required for the introduction of E10+ and other new transportation fuels. The general process for introduction of a new transportation fuel into commerce in California first requires a multimedia assessment to be conducted pursuant to Section 43840.8 of the California Health and Safety Code and approved by the California Environmental Policy Council. Such assessments are currently underway for biodiesel and renewable Diesel fuels and would be required<sup>†</sup> for E15 and higher gasoline-ethanol blends as well as for biobutanol

---

\* The relevant section of ASTM D4814 is Table 1, Footnote “G,” which allows for an alternative T50 minimum temperature of 66°C (150°F) for ethanol blends between E1 and E10, provided the gasoline blend stock meets a T50 minimum of 77°C (170°F). Section 2.1.3(b) of the current version (2010 amendment) of NIST Handbook 130 allows a T50 minimum temperature of 66°C (150°F) for ethanol blends up to E10. Vapor lock protection requirements in ASTM D4814 are given in Table 3 and associated footnotes.

<sup>†</sup> Cal/EPA Fuels Guidance Document, Draft for Comment, March 11, 2010.

A map of the United States where states are colored based on their T50 allowance status. Orange states include WA, ME, NH, MI, IL, MO, AR, MS, AL, GA, FL, VA, WV, KY, TN, NC, SC, DE, MD, NJ, CT, MA, and RI. Yellow states include OR, ID, MT, ND, MN, WI, IA, NE, KS, OK, TX, NM, AZ, NV, UT, CO, WY, SD, NY, PA, OH, IN, VT, NH, ME, CT, MA, RI, NJ, DE, MD, and HI. Alaska is also yellow. The legend at the bottom left shows an orange square for 'T50 Allowance' and a yellow square for 'No T50 Allowance'.

[illegible]



and other potential fuels. The time required to perform multimedia assessments varies depending on the fuel being considered, but such assessments have generally required several years to complete.

The second step in the process for introducing new transportation fuels into commerce in California involves the establishment of fuel specifications by the California Air Resources Board (CARB). CARB is currently in the process of developing such specifications for biodiesel and renewable Diesel fuels.\* One key policy that CARB applies during the development of fuel specifications for new transportation fuels is ensuring that their use does not result in increases in air pollutant emissions. As a result, the fuel specifications being developed for biodiesel are likely to include requirements for the use of additives or blending with renewable Diesel as a means to mitigate potential increases in emissions of oxides of nitrogen (NO<sub>x</sub>). The fuel specification development process also requires one to two years, although it is generally performed concurrently with the multimedia review.

The process of introducing new transportation fuels into California that are based on majority blends with gasoline (e.g., E15 or E20) is that all gasoline sold in California is required to comply with CARB's Phase 3 RFG regulations. At present, these regulations establish a blend cap at E10 that would have to be extended for E10+ blends. However, because most, if not all, gasoline sold in California is certified using CARB's Predictive Model, elimination of the E10 blend cap is not straightforward.

The Predictive Model is similar in concept to the EPA Complex Model, but separately addresses the emissions impacts of gasoline composition on multiple groups of vehicles that are defined by vintage and emissions control technology. The Predictive Model also accounts for ethanol-related permeation emissions. In order to modify the Predictive Model to accommodate E10+ blends, relatively extensive emission test programs would have to be performed and the resultant data collected and analyzed. The process of updating the Predictive Model to account for new information—e.g., the impacts of fuel composition on newer vehicle technologies—has been neither straightforward nor quick, and there is no reason to believe that the situation would be any different for its extension to E10+.

Another complicating factor is that in the course of MTBE being banned in California, CARB was directed to maintain the emission benefits associated with the original Phase 2 gasoline regulations. Therefore, to the extent that the revised Predictive Model indicates increases in NO<sub>x</sub> emissions or permeation emissions associated with E10+, CARB would likely propose other changes to the Phase 3 gasoline regulation—for example, further restrictions on sulfur content to mitigate those increased emissions. Similar or more intractable issues would be expected to be raised by CARB efforts to extend the Predictive Model to deal with other types of new transportation fuels that are based on blends with gasoline where gasoline constitutes the majority of the blend.

---

\* See <http://www.arb.ca.gov/fuels/diesel/altdiesel/biodiesel.htm>.

## 4.6 State Implementation Plans

Although a detailed review of all SIPs that could require changes as the result of the introduction of E10+ was outside the scope of this project, many states have individually adopted EPA's summertime RVP requirements or have adopted more stringent RVP requirements.\* For states that have adopted the federal requirements solely by reference either in an ozone plan or in a regulation, SIP changes may be necessary, even if the plan or regulation does not reference a waiver issued pursuant to Section 211(f)(4) of the Clean Air Act. In addition, states setting RVP limits more stringent than the federal requirements but providing a 1.0 RVP allowance for gasoline-ethanol blends during the summer would be required to make SIP revisions in order to extend those allowances to E10+. It should also be noted that changes to SIP-approved RVP requirements would require subsequent EPA approval.

In addition, changes to emission inventories associated with the introduction of E10+ and biodiesel blends may have an impact on the SIP attainment demonstrations and maintenance plans adopted in current and former nonattainment areas. Again, to the extent that SIP changes are necessary, they require EPA approval.

In order to illustrate the potential number of areas for which SIP changes might be required, Figure 4-6 reproduces the most current EPA map of ozone nonattainment areas. As shown, there are numerous nonattainment areas in a number of states that could be affected by the introduction of E10+ or expanded use of biodiesel blends.

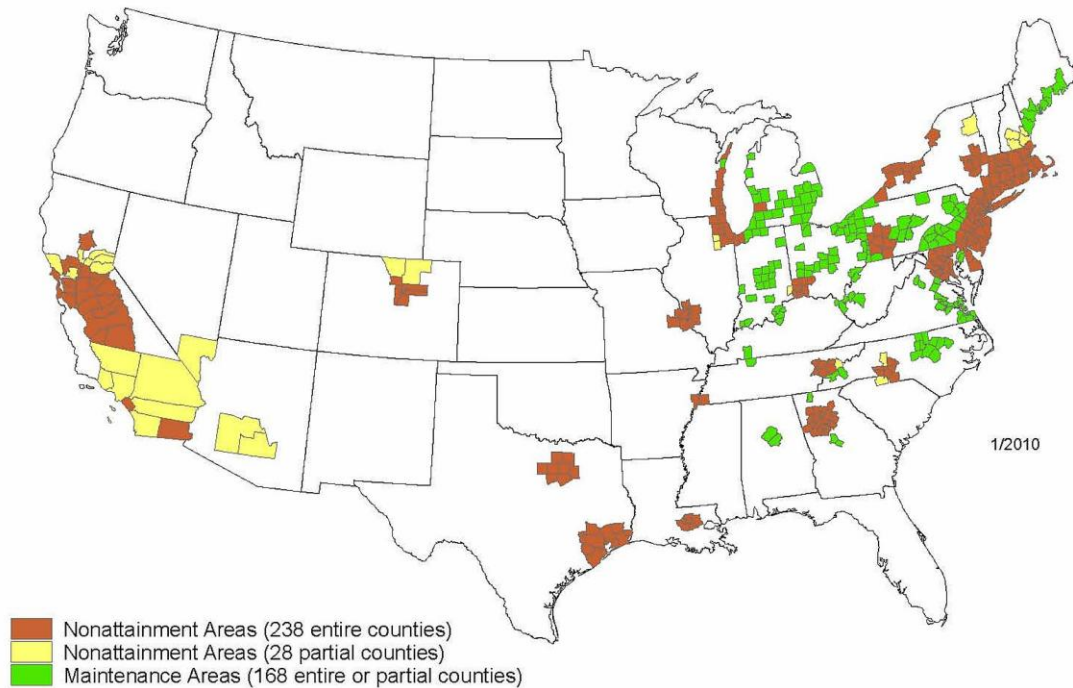
## 4.7 Summary of Changes to State Requirements

As discussed above and documented in Appendix A, numerous changes of various types to state local and regional fuel requirements may be needed in order for the commercialization of E10+, the expanded use of biodiesel, or the use of a wider range of biodiesel blends. These changes are summarized by state for E10+ and biodiesel in Tables 4-1 and 4-2, respectively. States in which there are currently nonattainment areas with respect to the ozone NAAQS are also highlighted to indicate the potential need for SIP changes. Finally, the tables also show the fraction of nationwide gasoline and Diesel fuel sales that occurred in each state in 2009 based on data from the Energy Information Administration.

---

\* 40 CFR 80.27

**Figure 4-6**  
**Nonattainment and Maintenance Areas in the U.S.**  
**8-Hour Ozone (1997 Standard)**



Partial counties, those with part of the county designated nonattainment and part attainment, are shown as full counties on this map.

**Table 4-1**  
**Summary of Identified State Changes Required for E10+**

State	Changes Required for E10+						% of Gasoline Sales	Ozone NA Areas
	Blend Cap	Summer RVP	RVP	Vapor Lock	T50 Offset	Other		
Alabama			X	X	X		1.90	
Alaska							0.20	
Arizona	X		X			X	2.08	X
Arkansas	X		X	X	X		1.02	X
California	X					X	11.33	X
Colorado			X				1.55	X
Connecticut	X						1.13	X
Delaware	X						0.33	X
District of Columbia							0.09	X
Florida	X		X	X	X		6.16	
Georgia		X		X	X		3.59	X
Hawaii	X						0.33	

**Table 4-1**  
**Summary of Identified State Changes Required for E10+**

State	Changes Required for E10+						% of Gasoline Sales	Ozone NA Areas
	Blend Cap	Summer RVP	RVP	Vapor Lock	T50 Offset	Other		
Idaho							0.47	
Illinois			X	X	X		3.68	X
Indiana		X					2.22	X
Iowa							1.12	
Kansas		X					0.93	
Kentucky		X		X	X		1.60	X
Louisiana							1.61	X
Maine	X		X	X	X		0.50	X
Maryland			X				1.96	X
Massachusetts							2.10	X
Michigan		X		X	X		3.43	X
Minnesota							1.87	X
Mississippi		X		X	X		1.20	
Missouri	X		X		X		2.31	
Montana	X						0.35	
Nebraska	X						0.59	
Nevada	X		X	X			0.85	X
New Hampshire	X		X	X	X		0.53	X
New Jersey							3.16	X
New Mexico							0.67	
New York	X						4.12	X
North Carolina		X		X	X		3.17	X
North Dakota	X	X					0.24	
Ohio							3.67	X
Oklahoma	X						1.32	
Oregon	X						1.11	
Pennsylvania							3.69	X
Rhode Island							0.29	X
South Carolina							1.83	X
South Dakota							0.29	
Tennessee	X	X		X	X		2.23	X
Texas							8.61	X
Utah	X						0.77	
Vermont							0.25	
Virginia	X		X	X	X		2.95	X
Washington	X		X	X	X		1.95	
West Virginia	X		X	X	X		0.60	
Wisconsin	X	X					1.82	X
Wyoming		X					0.23	

**Table 4-2**  
**Summary of Identified State Changes Required for Biodiesel**

State	Changes Required For Biodiesel		% of Diesel Sales	Ozone NA Areas
	General	Greater than B20		
Alabama	X		2.07	
Alaska			0.70	
Arizona			1.92	X
Arkansas			1.52	X
California	X		7.71	X
Colorado			1.30	X
Connecticut			0.69	X
Delaware			0.15	X
District of Columbia			0.02	X
Florida		X	4.14	
Georgia			3.51	X
Hawaii			0.56	
Idaho			0.65	
Illinois			3.56	X
Indiana			3.18	X
Iowa			1.56	
Kansas			1.27	
Kentucky	X	X	2.49	X
Louisiana			2.43	X
Maine			0.43	X
Maryland			1.34	X
Massachusetts			1.07	X
Michigan			2.11	X
Minnesota		X	1.76	X
Mississippi			1.68	
Missouri		X	2.52	
Montana			0.81	
Nebraska			0.98	
Nevada		X	0.85	X
New Hampshire			0.22	X
New Jersey			2.40	X
New Mexico	X		1.18	
New York	X		2.63	X
North Carolina	X		2.49	X
North Dakota			0.66	
Ohio			4.25	X
Oklahoma	X		2.63	
Oregon			1.46	
Pennsylvania			3.56	X

**Table 4-2**  
**Summary of Identified State Changes Required for Biodiesel**

State	Changes Required For Biodiesel		% of Diesel Sales	Ozone NA Areas
	General	Greater than B20		
Rhode Island			0.17	X
South Carolina			1.66	X
South Dakota			0.46	
Tennessee		X	2.74	X
Texas			10.76	X
Utah			1.15	
Vermont			0.14	
Virginia	X		2.70	X
Washington			2.22	
West Virginia			0.78	
Wisconsin			1.73	X
Wyoming		X	1.04	

###

## 5. VEHICLE AND ENGINE WARRANTIES

The mandatory introduction of new transportation fuels (i.e., oxygenated and reformulated gasolines as well as low and ultra-low sulfur Diesel fuels) into commerce in response to government regulations over the past 30 years has often led to unforeseen adverse impacts on the performance of existing vehicles and engines and, in some cases, damage. For example, the original introduction of gasoline-ethanol blends as well as methanol-cosolvent blends with gasoline in the late 1970s and early 1980s led to a number of problems; these included engine and fuel system damage due to the blends being incompatible with materials then in-use, and operability problems that were due to factors such as the affinity of the blends for water and the tendency for phase separation into gasoline and alcohol layers. Similar issues were observed with fuel system materials during the introduction of low-sulfur/low aromatic Diesel fuel during 1993<sup>\*</sup> and both CARB<sup>†</sup> and EPA<sup>‡</sup> were concerned about potential for adverse impacts to be caused by the introduction of RFG prior to its introduction in the 1995-1996 timeframe.

Given the history of unforeseen adverse impacts and potential liabilities associated with the introduction of new transportation fuels, significant concerns have been raised regarding commercialization of E10+ and biodiesel blends at levels above those that vehicle and engine manufacturers have deemed to be acceptable. This section reviews vehicle and engine manufacturer warranties related to ethanol-gasoline and biodiesel blends, and summarizes other information and data regarding the suitability of E10+ and biodiesel blends for use in existing vehicles and engines.

### 5.1 Light-Duty Gasoline Vehicles

An important issue with respect to E10+ blends and other new transportation fuels based on majority gasoline blends is the fact that such fuels may void automobile warranties, creating potential liabilities for vehicle owners. In order to gain insight into this issue, Sierra performed a review of the Herman and Associates database of federal and state legislation and regulatory motor fuel laws and regulation, which includes owner's manual statements regarding the use of ethanol blends in non-flexible fueled vehicles for the 1999, 2000, 2003, 2006, 2009, and 2010 model years. The results of this review for model years in the database are shown in Table 5-1.

---

<sup>\*</sup> "Report of the Diesel Fuel Task Force," February 1994.

<sup>†</sup> "California Reformulated Gasoline: Performance and Compatibility Test Program," California Air Resources Board, March, 1996.

<sup>‡</sup> See <http://www.epa.gov/otaq/rfg/information.htm>

<b>Table 5-1</b> <b>Manufacturer Limits on Allowable Ethanol Content in Conventional Vehicles</b> <b>(Based on Owners Manual Review Conducted by Herman and Associates)</b>						
<b>Manufacturer</b>	<b>1999</b>	<b>2000</b>	<b>2003</b>	<b>2006</b>	<b>2009</b>	<b>2010</b>
Audi	10%	10%	-	10%	10%	10%
Bentley	- <sup>a</sup>	-	-	10%	10%	10%
BMW	10%	10%	10%	10%	10%	10%
Chrysler	10%	10%	10%	10%	10%	10%
Ford	10%	10%	N.S.	10%	10%	10%
GM	N.S. <sup>b</sup>	N.S.	N.S.	N.S.	10%	10%
Honda/Acura	10%	10%	10%	10%	10%	10%
Hyundai	10%	10%	10%	10%	10%	10%
Jaguar	10%	10%	10%	10%	10%	10%
Isuzu	-	N.S.	N.S.	10%	-	-
Kia	10%	10%	10%	10%	10%	10%
Land Rover	10%	10%	10%	10%	10%	10%
Lexus	-	10%	-	-	10%	10%
Maserati	-	-	-	-	-	10%
Ferrari	-	-	Avoid <sup>c</sup>	Avoid	-	-
Mazda	10%	10%	10%	10%	10%	10%
Mercedes-Benz	10%	10%	10%	10%	10%	10%
Mitsubishi	10%	10%	10%	10%	-	-
Nissan/Infiniti	10%	10%	10%	10%	10%	10%
Porsche	N.S.	N.S.	N.S.	N.S.	10%	10%
Saab	10%	10%	10%	10%	10%	10%
Subaru	10%	10%	10%	10%	10%	
Rolls Royce	10%	10%	-	10%	-	-
Suzuki	10%	10%	10%	10%	10%	10%
Toyota	10%	10%	10%	10%	10%	10%
Volkswagen	10%	10%	10%	10%	10%	10%
Volvo	10%	10%	10%	10%	10%	10%

<sup>a</sup>Not reviewed

<sup>b</sup>No numeric limit specified.

<sup>c</sup>Alcohol-containing fuel not suggested.



As shown, manufacturers for which information was available from Herman and Associates have uniformly established 10% ethanol by volume as the maximum allowable level in their owner's manuals through the 2010 model year. Given this, manufacturers may take the position that they are not required to address adverse impacts caused by the use of E10+ in existing vehicles under either their normal warranties or the emission control system warranties required by EPA and CARB.

In addition to the limits on allowable ethanol levels in the owner's manuals, there is some evidence that the Growth Energy waiver request and other discussions of the commercial introduction of E10+ blends have heightened manufacturer concerns. For example, in its 1999 model year manuals, General Motors (GM) stated:

*In addition, gasolines containing oxygenates, such as ethers and ethanol, and reformulated gasolines may be available in your area to contribute to clean air. General Motors recommends that you use these gasolines if they comply with the specifications described earlier.*

In contrast, that language was changed in the 2009 model year manual to the following:

*Gasolines containing oxygenates, such as ethers and ethanol, and reformulated gasolines might be available in your area. We recommend that you use these gasolines, if they comply with the specifications described earlier. However, E85 (85% ethanol) and other fuels containing more than 10% ethanol must not be used in vehicles that were not designed for those fuels.*

Given the above, it is not clear how EPA has established that 2001 and later model-year vehicles would be compatible with E10+ blends should it elect to provide a partial waiver to the Growth Energy E15 petition.

In addition to the warranty issue, there are other concerns with the use of E10+ blends and other potential new transportation fuels in existing vehicles. Although some of these concerns should be addressed by EPA in the Clean Air Act Substantially Similar and waiver procedures for new fuels, it is not clear that all issues will be resolved. Questions that may not be answered include the impacts of the long-term use of new transportation fuels, including E10+ blends, on engines and emission control systems as well as impacts on engine calibrations and on-board diagnostic systems. These concerns are significant enough that they are being addressed through testing and studies being conducted by organizations such as the Coordinating Research Council.

## 5.2 Other Gasoline-Fueled Equipment

The concerns of manufacturers of gasoline-fueled engines used in non-automotive applications and the use of E10+ blends are well established, as evidenced by EPA's suggestion that only a partial waiver of the Growth Energy petition may be feasible. Perhaps the most extensive summary of these concerns can be found in the comments of the Alliance for a Safe Alternative Fuels Environment (ALLSAFE) and the Outdoor Power Equipment Institute (OPEI) that were submitted to the EPA Docket regarding the Growth Energy petition.

The concerns raised by ALLSAFE regarding the use of E10+ blends in other gasoline-fueled equipment include the following:

- Engine operability problems, including loss of power, stalling and overheating;
- Substantially shorted engine life due to enleaned of air-fuel ratios;
- Catastrophic engine failures;
- Incompatibility with fuel system materials; and
- Increases in exhaust and evaporative emissions levels.

## 5.3 Diesel Vehicle/Engine Warranties and Biodiesel Blends

Sierra also performed a general review of information available regarding owner's manual and engine warranty statements for Diesel vehicles and engines with respect to biodiesel. This information is summarized by manufacturer in Table 5-2 based on limits for existing vehicles and engines. As shown, B5 limits predominate although some manufacturers with B5 limits have announced plans for new products with B20 limits. Note that all manufacturers specify that biodiesel blends and blend stocks meet ASTM or similar requirements.

The fact that many existing Diesel vehicles and engines are compatible only with biodiesel blends up to B5 will obviously limit the degree to which higher-level biodiesel blends can be introduced. This conclusion is reinforced by statements such as the following from 2010 Mercedes owner's manuals with respect to blends above B5:

*Diesel fuels containing a higher percentage of biodiesel, e.g. B20, as well as straight biodiesel may cause severe damage to your engine/fuel system and are not approved.*

<b>Table 5-2 Manufacturer Limits on Biodiesel Blends for Existing Vehicles and Engines</b>	
<b>Manufacturer</b>	<b>Limits for Existing Vehicles/Engines</b>
Audi	B5
BMW	B5
Caterpillar	B5 to B30
Chrysler	B5 to B20
Cummins	B5 to B20
Detroit Diesel	B5
Ford	B5
General Motors	B5 to B20
Navistar	B5 to B20
Isuzu	B5
John Deere	B20
Kubota	B5
Mack	B5
Mercedes Benz	B5
Volkswagen	B5
Volvo	B5
Yanmar	B20

###

## 6. FUEL STORAGE, MARKETING, AND DISTRIBUTION

The storage, marketing, and distribution of E10+, biodiesel fuel, and other potential new transportation fuels represents another area where extensive and time-consuming changes may be required for the widespread commercialization of these fuels.

With respect to retail fuel outlets, numerous interrelated organizations and standards exist regarding the installation and operation of fueling infrastructure. Existing throughout are requirements that equipment be “*compatible*” with the product being stored and dispensed and that the equipment be “*listed*” by independent organizations such as Underwriters Laboratories. Organizations and regulatory agencies with jurisdiction over fuel dispensing facilities include those listed below.

- Occupational Safety and Health Administration (OSHA)
- National Fire Protection Association (NFPA)
- International Code Council (ICC)
- Underwriters Laboratories (UL)
- EPA
- American National Standards Institute (ANSI)

In addition, many states and localities have regulatory agencies with jurisdiction over fuel dispensing facilities as well as over the labeling of fuel dispensers and product advertising.

This section summarizes the challenges that retail fuel outlets will have to overcome in order to market E10+ and biodiesel, as well as Sierra’s review of changes that would be required to existing pump labels.

### 6.1 Pipelines and Terminals

One major issue associated with the introduction of E10+ blends, particularly in light of EPA’s suggestion that only a partial waiver will be provided to Growth Energy for E15, is whether they will use the same or different blendstocks as E10 blends. To the extent that the same blendstocks are used for E10 and E10+, it is expected that changes in pipeline specifications and storage and terminal operations will be minimized; however, use of different blendstocks will require the establishment of separate pipeline

specifications for E10+ blendstocks and create the need for separate storage tanks at terminals.

At present, ethanol is generally transported by barge, rail, and truck separately from gasoline; stored separately from gasoline; and blended into gasoline at distribution terminals. As ethanol use expands, particularly in conjunction with E10+ blends, there will be greater interest in the transport of ethanol and gasoline-ethanol blends by pipeline and the storage of blends at terminals. Concerns include the following:

- Water entrainment and phase separation of gasoline and ethanol;
- Degradation of materials used in pipelines and storage tank by ethanol and gasoline-ethanol blends; and
- Stress corrosion cracking of pipelines.

With respect to biodiesel and pipeline transport, so-called “trailback,” which degrades jet fuel quality, is a significant issue.

## 6.2 Requirements for Retail Fuel Outlets

The introduction of E10+ and the expanded use of biodiesel raise the same types of issues with existing equipment at fuel outlets as they do with respect to existing vehicles, which are primarily related to the compatibility of the fuels with materials used in storage and dispensing systems. These concerns raise liability issues for fueling outlets, and the marketing of E10+<sup>\*</sup> and/or biodiesel<sup>†</sup> could cause outlets to be in violation of local building or fire codes.

Equipment that may need to be modified or replaced in order to accommodate E10+ and biodiesel includes the following:

- Hanging hardware (nozzles, hoses, breakaways, and swivels);
- Dispensers;
- Product pumps;
- Underground storage tanks;
- Leak detection systems;
- Vapor recovery systems; and
- All associated piping.

---

<sup>\*</sup> For a summary of ethanol-related code issues see  
[http://www.afdc.energy.gov/afdc/pdfs/ethanol\\_codes\\_standards.pdf](http://www.afdc.energy.gov/afdc/pdfs/ethanol_codes_standards.pdf)

<sup>†</sup> For a summary of biodiesel-related code issues see  
[http://www.afdc.energy.gov/afdc/pdfs/biodiesel\\_codes\\_standards.pdf](http://www.afdc.energy.gov/afdc/pdfs/biodiesel_codes_standards.pdf)

There are myriad requirements and industry practices that apply to retail fuel outlets that may have to be changed in order to accommodate the use of E10+ and biodiesel. This issue is greatly complicated by the fact that these requirements and practices can vary substantially depending on where the outlet is located. These requirements and practices have been summarized by API and are presented in Appendix B.

Of particular concern are requirements found in most building and fire codes that specify that gasoline dispensers and associated dispensing equipment be “listed” by a nationally recognized third-party testing laboratory. The most highly regarded example of this type of organization is Underwriters Laboratory (UL), which is an independent product safety certification organization. UL develops standards and performs testing to insure that products meet the requirements of the standards. Those products meeting the standards are permitted to carry “UL Recognized” marks, identifying the product as conforming to the standard.

Local building code enforcement and fire inspectors are generally responsible for ensuring that new and existing construction in their area of jurisdiction comply with applicable regulations and codes (OSHA, NFPA, and ICC). Compliance generally refers to a listing by an organization such as UL. While alternative means of acceptance can be permitted, a UL listing is generally the least ambiguous path to compliance for a location marketing transportation fuels.

UL<sup>\*</sup> has issued the standards related to dispensing equipment to be used with gasoline-ethanol blends. For blends of up to 10% ethanol, dispensers are evaluated relative to the established requirements of UL 87 and other existing UL standards. In addition, UL has established UL Subject 87A-E85 and UL Subject 87A-E25, which address dispensers intended for use with E85 and E25, respectively. At present, only two dispensing systems have met all of the requirements of Subject 87A-E85 and only one system has met the requirements of 87A-E25. However, additional approvals are imminent and will provide a clear path for new service stations.

The most significant issue, however, is that the existing equipment has not been evaluated with respect to E15, and UL does not list installed equipment without required testing.<sup>†</sup> Given that UL listing is required for equipment used at retail fuel outlets, this could place those outlets marketing E10+ in violation of local building and fire codes and OSHA requirements. In recognition of this issue, UL has issued an opinion<sup>‡</sup> announcing support for Authorities Having Jurisdiction (AHJ) who may choose to permit legacy systems with UL 87 listing to be used to dispense fuel blends up to a maximum of 15% ethanol. In their press release, UL states that “UL determined that there is no significant incremental risk of damage between E10 and fuels with a maximum of 15 percent ethanol. This conclusion was reached after careful examination of the effects of varying levels of ethanol on components.” AHJs are, however, “advised to consult with the dispenser manufacturer to confirm that the dispenser is compatible with the fuel to be

---

<sup>\*</sup> See [http://www.afdc.energy.gov/afdc/technology\\_bulletins.html](http://www.afdc.energy.gov/afdc/technology_bulletins.html)

<sup>†</sup> See [http://www.afdc.energy.gov/afdc/technology\\_bulletin\\_0307.html](http://www.afdc.energy.gov/afdc/technology_bulletin_0307.html)

<sup>‡</sup> UL Press Release, Feb 19, 2009

dispensed.” In addition, “dispensers pumping this higher percentage of ethanol should be subject to regular inspection and preventative maintenance as specified by the dispenser manufacturer for the blend of fuel being dispensed because the potential for degradation of the metals and materials (e.g., plastics, elastomers and composites) used in a dispensing system increases as the percentage of ethanol increases.”

A few state jurisdictions have issued workarounds or waivers that allow the use of legacy and newer dispensing equipment.<sup>\*</sup> Most of these workarounds require periodic inspections and replacement of the unlisted equipment with listed equipment once such equipment becomes available. Note, however, that these workarounds do not exempt retailers from federal OSHA requirements for listed dispensing equipment.

This does not resolve any of the long-term issues associated with E10+ dispensing at retail outlets because the legacy equipment is not “listed” as required. It is unclear whether the UL announcement applies only to the dispenser or to all aboveground dispensing equipment (i.e., hanging hardware, breakaways, etc.). Ultimately, as noted above, as listed equipment becomes available, it will eventually have to replace legacy equipment.

Issues similar to those discussed above may apply to other new transportation fuels, including biodiesel and biodiesel blends.<sup>†</sup>

### 6.3 Changes in Pump Labeling

Changes in federal pump labeling requirements were reviewed in Section 3. Sierra reviewed state labeling and advertising requirements to determine what if any changes would be required to address the introduction of E10+ and the expanded use of biodiesel fuels. This review was conducted using the Herman and Associates database of federal and state legislation and regulatory motor fuel laws and regulations. The review found that state regulations regarding advertising and labeling may require modification to accommodate E10+ and expanded use of biodiesel blends, although many are cast in a form that requires only the posting of labels on fuel dispensers alerting consumers to the fact that the fuel contains ethanol or biodiesel.

Many states specify that labels include the percentage, or maximum percentage, of ethanol or biodiesel that is in the fuel. As a result, the introduction of E10+ or higher-level biodiesel blends will require the replacement or multiple replacements of pump labels depending on how new transportation fuels are introduced. Figure 6-1 identifies those states for which Sierra determined, based on its review of the Herman and Associates database of federal and state legislation and regulatory motor fuel laws and regulations, that pump label changes would be required

---

<sup>\*</sup> See, for example, Policy Number 06-PCS-005 regarding alternative fuel compatibility issued by the State of Illinois Office of the State Fire Marshal, effective December 15, 2006.

<sup>†</sup> Biodiesel Handling and Use Guide, Fourth Edition, NREL/TP-540-43672, Revised December 2009.

A map of the United States showing state income tax status. States are colored blue if they have a state income tax ('Yes') and yellow if they do not ('No').

State	Income Tax Status
AK	No
AL	No
AR	Yes
AZ	Yes
CA	No
CT	Yes
DE	Yes
FL	Yes
GA	Yes
HI	No
ID	No
IL	Yes
IN	No
IOWA	Yes
KANSAS	Yes
KY	No
LA	Yes
MA	Yes
Maryland	Yes
ME	No
MI	No
Minnesota	No
MO	No
MS	No
MT	No
NH	No
NJ	Yes
NM	No
NC	No
ND	No
NE	No
Nevada	No
NV	No
NY	Yes
OH	No
OK	Yes
OR	Yes
PA	No
Rhode Island	Yes
SC	No
SD	No
Tennessee	No
Texas	No
TN	No
TX	No
UT	Yes
Vermont	No
VA	Yes
VT	No
WA	Yes
WI	Yes
WV	No
WY	Yes
ZC	Yes

###



## Appendix A

### Summary of Changes Required in Order for E10+ and Other New Transportation Fuels to be Introduced into Commerce

**Summary of Changes Required in Order for E15 and  
Other New Transportation Fuels to be Introduced into Commerce**

<b>Regulations Pertaining to:</b>	<b>Specific Change Required</b>	<b>Responsible Agency</b>	<b>Time Required</b>
<b>ALABAMA</b>			
Ethanol Blends T50 Minimum Offset	Extend T50 minimum offset from AAC 80-1-16-.03 to blends higher than E10	Alabama Dept. of Agriculture and Industries	12 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from AAC 80-1-16-.03 to blends higher than E10	Alabama Dept. of Agriculture and Industries	12 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection offset (T V/L=20) from AAC 80-1-16-.03 to blends higher than E10	Alabama Dept. of Agriculture and Industries	12 Months
Reid Vapor Pressure	Remove the 10% ethanol blending limit qualifying for the 1.0 psi RVP offset from AAC 335-3-20-.01(b) and 335-3-20-.02(4)(b)(1)	Alabama Dept. of Environmental Management	12 Months
Biodiesel Specifications	Modify various properties of diesel fuel contained in AAC 80-1-18-.04	Alabama Dept. of Agriculture and Industries	12 Months
<b>ALASKA</b>			
	No Changes Required		
<b>ARIZONA</b>			
Ethanol Blending Cap	Remove 10% ethanol blending restriction in Table 2 of R20 Article 7	Arizona Dept. of Weights and Measures	18 Months
Ethanol Blending Cap	Modify ARS 41-2124 to allow fuels other than Federal RFG or California Phase 3 RFG	Arizona Legislature	24 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from AAC R20-2-708 to blends higher than E10	Arizona Dept. of Weights and Measures	18 Months
Maximum Oxygen Content	Raise the maximum oxygen content for gasoline in R20-2-708, R20-2-751(A)(7)(b) and Table 2 of R20 Article 7	Arizona Dept. of Weights and Measures	18 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>ARKANSAS</b>			
Ethanol Blending Cap	Remove 10% ethanol blending cap contained in the NIST Handbook 130, Section 2.1.2, adopted by reference by AC 4-108-204 and 4-108-212	Arkansas State Legislature Arkansas State Plant Board	12 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset contained in the NIST Handbook 130, Section 2.1.3(a), adopted by reference by AC 4-108-204 and 4-108-212 to blends higher than E10	Arkansas State Legislature Arkansas State Plant Board	12 Months
Ethanol Blends T50 Minimum Offset	Extend T50 minimum offset contained in the NIST Handbook 130, Section 2.1.3(b), adopted by reference by AC 4-108-204 and 4-108-212 to blends higher than E10	Arkansas State Legislature Arkansas State Plant Board	12 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection offset (T V/L=20) contained in the NIST Handbook 130, Section 2.1.3(b), adopted by reference by AC 4-108-204 and 4-108-212 to blends higher than E10	Arkansas State Legislature Arkansas State Plant Board	12 Months
<b>CALIFORNIA</b>			
Ethanol Blending Cap	Extend 10% ethanol blend limit in §2262 Title 13 CCR to higher ethanol blends. This may require a multimedia evaluation pursuant to CA H&S Code §43830.8	California Air Resources Board	24 Months
Predictive Model	Extend the range of the Predictive Model so that it applies to fuels with more than 10% ethanol	California Air Resources Board	24 Months
Biodiesel Specifications	Adopt fuel specifications for biodiesel and perform multimedia evaluation pursuant to CA H&S Code §43830.8	California Air Resources Board and California Environmental Policy Council	24 Months
Biodiesel Blending Restriction	Modify the requirement that biodiesel blends meet ASTM D975 in CCR §4147	California Dept. of Food and Agriculture	12 Months
Other New Transportation Fuels	Adopt fuel specifications for new transportation fuels and perform multimedia evaluations required by CA H&S Code §43830.8	California Air Resources Board and California Environmental Policy Council	24 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>COLORADO</b>			
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814 in Colorado Statutes 8-20-204 to blends higher than E10	Colorado General Assembly	12 Months
<b>CONNECTICUT</b>			
Ethanol Blending Cap	Remove the 10% ethanol blending cap for “gasohol” in Conn. Regs. §14-327d-1.27 and in §14-327d-2.11	Connecticut Dept. of Consumer Protection	18 Months
<b>DELAWARE</b>			
Ethanol Blending Cap	1. Remove the 10% ethanol blending cap for “gasohol” in 30 DC §5101.5 2. Remove the 10% ethanol blending cap for “gasohol” in DAC Title 2, Chapter 2244, Subchapter 1, §1.2 and §1.9.1	1. Delaware General Assembly 2. Delaware Dept. of Transportation	24 Months
<b>DISTRICT OF COLUMBIA</b>			
	No Changes Required		
<b>FLORIDA</b>			
Ethanol Blending Cap	1. Remove 10% ethanol blending cap in FS Title XXXIII, Chapter 526.06 2. Remove 10% ethanol cap from definition of blended gasoline. 3. Remove ethanol blending caps for gasoline in FAC 5F 2.001(1)(c)(1) and (4)	1. Florida Legislature 2. Florida Legislature 3. Florida Dept. of Agriculture and Consumer Services	24 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814 in FAC 5F-2.001(1)(a)(1) to blends higher than E10	Florida Dept. of Agriculture and Consumer Services	12 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection offset (T V/L=20) from ASTM D4814 in FAC 5F-2.001(1)(a)(3) to blends higher than E10	Florida Dept. of Agriculture and Consumer Services	12 Months
Ethanol Blends T50 Minimum Offset	Extend T50 minimum offset from ASTM D4814 in FAC 5F-2.001(1)(a)(2) to blends higher than E10	Florida Dept. of Agriculture and Consumer Services	12 Months
Biodiesel Blending Cap	Remove 20% blending cap for biodiesel in FAC 5F-2.001(5)(d)(2)	Florida Dept. of Agriculture and Consumer Services	12 Months

**Summary of Changes Required in Order for E15 and  
Other New Transportation Fuels to be Introduced into Commerce**

<b>Regulations Pertaining to:</b>	<b>Specific Change Required</b>	<b>Responsible Agency</b>	<b>Time Required</b>
<b>GEORGIA</b>			
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from GA Rule 20-1-.01(a)(5)(iii) in GA Rule 40-20-1-.01(b)(1)(iii) and GA Rule 40-20-1-.01(b)(4) to blends higher than E10	Georgia Dept. of Agriculture	12 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection offset (T V/L=20) from GA Rule 40-20-1-.01(a)(5)(iii) in GA Rule 40-20-1-.01(b)(1)(ii) to blends higher than E10	Georgia Dept. of Agriculture	12 Months
Ethanol Blends T50 Minimum Offset	Extend T50 minimum offset from GA Rule 40-20-1-.01(a)(5)(i) in GA Rule 40-20-1-.01(b)(1)(i) to blends higher than E10	Georgia Dept. of Agriculture	12 Months
Reid Vapor Pressure	Extend 1.0 psi RVP offset in GA Rule 391-3-1-.02(2)(bbb)(2)(ii)(I) in the Atlanta ozone nonattainment area to ethanol blends higher than E10	Georgia Dept. of Natural Resources	12 Months
<b>HAWAII</b>			
Ethanol Blending Cap	1. Remove 10% blending cap in HRSA § 486J-10 2. Remove 10% blending cap in the definition of “Ten per cent ethanol by volume” in HAR §15-35-2	Hawaii Legislature, Hawaii Dept. of Business, Economic Development and Tourism	24 Months 12 Months
<b>IDAHO</b>			
	No Changes Required		
<b>ILLINOIS</b>			
Ethanol Blends Vapor Pressure Offset	Revise 8 IAC §850.60 which references NIST Handbook 130 to extend 1 psi vapor pressure offset to blends higher than E10	Illinois Dept. of Agriculture	12 Months
Ethanol Blends Vapor Lock Protection Offset	Revise 8 IAC §850.60 which references NIST Handbook 130 to extend vapor lock protection (T V/L=20) offset to blends higher than E10	Illinois Dept. of Agriculture	12 Months
Ethanol Blends T50 Minimum Offset	Revise 8 IAC §850.60 which references NIST Handbook 130 to extend T50 minim offset to blends higher than E10	Illinois Dept. of Agriculture	12 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
Reid Vapor Pressure	Extend 1.0 psi RVP offset in 35 IAC §219.585(c) to blends higher than E10 sold in the Metro East Area	Illinois Environmental Protection Agency	12 Months
<b>INDIANA</b>			
Reid Vapor Pressure	Extend 1.0 psi RVP offset in 326 IAC 13-3-5 to blends higher than E10 sold in Clark and Floyd Counties	Indiana Dept. of Environmental Management	12 Months
<b>IOWA</b>			
	No Changes Required		
<b>KANSAS</b>			
Reid Vapor Pressure	Extend 1.0 psi RVP offset in 28-19-719(c)(2) to blends higher than E10 sold in Johnson or Wyandotte Counties and revise associated SIP requirement	Kansas Dept. of Health and the Environment	12 Months
<b>KENTUCKY</b>			
Ethanol Blends Vapor Pressure Offset	1. Extend 1 psi vapor pressure offset in KRS 363.904(1)(b)(2) to blends higher than E10 2. Extend 1 psi vapor pressure offset in 302 KAR 79:010 §3(a) and (b) to blends higher than E10	1. Kentucky Legislature 2. Kentucky Dept. of Agriculture	24 Months
Ethanol Blends Vapor Lock Protection Offset	1. Extend vapor lock protection (V/L=20) offset in KRS 363.904(1)(b)(2) to blends higher than E10 2. Extend vapor lock protection (V/L=20) offset in 302 KAR 79:010 §3(a) to blends higher than E10	1. Kentucky Legislature 2. Kentucky Dept. of Agriculture	24 Months
Ethanol Blends T50 Minimum Offset	1. Extend T50 minimum offset in KRS 363.904(1)(b)(2) to blends higher than E10 2. Extend T50 minimum offset in 302 KAR 79:010 §3(a) to blends higher than E10	1. Kentucky Legislature 2. Kentucky Dept. of Agriculture	24 Months
Biodiesel Blending Cap	Modify definition of “motor fuel” in KRS 363.900(7) to include biodiesel blends in excess of B2 (as allowed by KRS 363.905(5)); specify ASTM standards for biodiesel blends in KRS 363.902(2)	Kentucky Legislature	12 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>LOUISIANA</b>			
	No Changes Required		
<b>MAINE</b>			
Ethanol Blending Cap	Adopt regulation to remove 10% ethanol blending cap contained in the NIST Handbook 130, Section 2.1.2, incorporated by reference in Maine Public Law 192, LD 420 (HP 308)	Maine Legislature Maine Dept. of Agriculture	24 Months
Ethanol Blends Vapor Pressure Offset	Adopt regulation to extend 1 psi vapor pressure offset contained in the NIST Handbook 130, Section 2.1.3(a), to blends higher than E10, adopted by reference in Maine Public Law 192, LD 420 (HP 308)	Maine Legislature Maine Dept. of Agriculture	24 Months
Ethanol Blends Vapor Lock Protection Offset	Adopt regulation to extend vapor lock protection (T V/L=20) offset contained in the NIST Handbook 130, Section 2.1.3(a), to blends higher than E10, adopted by reference in Maine Public Law 192, LD 420 (HP 308)	Maine Legislature Maine Dept. of Agriculture	24 Months
Ethanol Blends T50 Minimum Offset	Adopt regulation to extend T50 minimum offset contained in the NIST Handbook 130, Section 2.1.3(b), to blends higher than E10, adopted by reference in Maine Public Law 192, LD 420 (HP 308)	Maine Legislature Maine Dept. of Agriculture	24 Months
<b>MARYLAND</b>			
Ethanol Blends Vapor Pressure Offset	Revise Code of Maryland Regulations Section 03.03.05.01-1 to provide RVP exemption to E10+_blends during winter months	Maryland Comptroller of the Treasury	24 Months
<b>MASSACHUSETTS</b>			
	No Changes Required		
<b>MICHIGAN</b>			
Ethanol Blends Vapor Pressure Offset	Extend vapor pressure offset in MAC R 285.564.4(g) to blends higher than E10	Michigan Legislature Michigan Dept. of Agriculture	24 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection (T V/L=20) offset in MAC R 285.564.2(5)(b) to blends higher than E10	Michigan Legislature Michigan Dept. of Agriculture	24 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
Ethanol Blends T50 Minimum Offset	Extend the T50 minimum offset in MAC R 285.564.4(d)(ii) to blends higher than E10	Michigan Legislature Michigan Dept. of Agriculture	24 Months
Maximum Oxygen Content	Increase gasoline maximum oxygen content in MAC R 285.564.2	Michigan Legislature Michigan Dept. of Agriculture	24 Months
Reid Vapor Pressure	Extend a 1 psi RVP offset in R 285.561.8 to blends higher than E10 sold in Southeast Michigan and associated SIP revisions	Michigan Dept. of Environmental Quality	12 Months
<b>MINNESOTA</b>			
Biodiesel Blending Cap	Remove the 20% biodiesel blending range maximum in the definition of “biodiesel blends” in MS §239.77(1)	Minnesota Legislature	12 Months
Ban on ETBE and TAME	Eliminate the ban on ETBE and TAME in MS §239.761(6)(b)	Minnesota Legislature	12 Months
<b>MISSISSIPPI</b>			
Ethanol Blends Vapor Pressure Offset	Extend 1.0 psi vapor pressure offset in Mississippi Administrative Rules Subpart 4, Chapter 8, §108.02(2) to blends higher than E10	Mississippi Dept. of Agriculture and Commerce	24 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection (T V/L=20) exemption in Administrative Rules Subpart 4, Chapter 8, §108.02(5) to blends higher than E10	Mississippi Dept. of Agriculture and Commerce	24 Months
Ethanol Blends T50 Minimum Offset	Extend the T50 minimum offset in Administrative Rules Subpart 4, Chapter 8, §108.02(4) to blends higher than E10	Mississippi Dept. of Agriculture and Commerce	24 Months



Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>MISSOURI</b>			
Ethanol Blending Cap	1. Remove 10% cap from the definition of “ethanol-blended gasoline” in MRS §414.255. 1(3)	1. Missouri General Assembly	24 Months
	2. Remove 10% alcohol and 3.7 weight percent oxygen caps in CSR§90-30.040(1)(C)	2. Missouri Dept. of Agriculture	24 Months
	3. Remove 10% cap from the definition of “ethanol-blended gasoline” in CSR §110-3.010(1)(A)	3. Missouri Dept. of Agriculture	24 Months
Ethanol Blends Vapor Pressure Offset	Extend RVP exemption from E10 in CSR§90-30.040(1)(C) to higher blends	Missouri Dept. of Agriculture	24 Months
Ethanol Blends T50 Minimum Offset	Extend T50 minimum from E10 in CSR§90-30.040(1)(C) to higher blends	Missouri Dept. of Agriculture	24 Months
Biodiesel Blending Cap	Modify MRS §414.032.1 to allow for biodiesel blends for which there is no ASTM standard (B21-B99)	Missouri General Assembly	12 Months
<b>MONTANA</b>			
Ethanol Blending Cap	Remove 10% ethanol blending cap from SB293	Montana Legislature	12 Months
<b>NEBRASKA</b>			
Ethanol Blending Cap	Extend policy that “gasoline that is shipped and will be shipped to terminals during the winter months is suitable for blending with up to 10% volume ethanol and is deemed to meet the standards adopted and enforced by the state of Nebraska” to higher ethanol blends.	Nebraska Department of Agriculture	6 Months
<b>NEVADA</b>			
Ethanol Blending Cap	Remove 10% ethanol blending cap for gasoline in NAC 590.065(7)(d)	Nevada Dept. of Agriculture	24 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814 in NAC 590.065(5)(d)(4) to blends higher than E10	Nevada Dept. of Agriculture	24 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection offset (T V/L=20) in NAC 590.065(5)(d)(5) to blends higher than E10	Nevada Dept. of Agriculture	24 Months
Biodiesel Blending Cap	Remove 20% biodiesel cap and modify referenced ASTM standards in NAC 590.051(3)	Nevada Dept. of Agriculture	24 Months
<b>NEW HAMPSHIRE</b>			
Ethanol Blending Cap	Remove 10% ethanol blending cap for gasoline in NIST Handbook 130 Section 2.1.2, incorporated by reference in NHRSA 438:20	New Hampshire General Court	12 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from NIST Handbook 130 Section 2.1.3(a), incorporated by reference in NHRSA 438:20, to blends higher than E10	New Hampshire General Court	12 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection offset (T V/L=20) from NIST Handbook 130 Section 2.1.3(c), incorporated by reference in NHRSA 438:20, to blends higher than E10	New Hampshire General Court	12 Months
Ethanol Blends T50 Minimum Offset	Extend T50 minimum offset from NIST Handbook 130 Section 2.1.3(b), incorporated by reference in NHRSA 438:20, to blends higher than E10	New Hampshire General Court	12 Months
Ban on Ethers and Higher Alcohols	Eliminate the ban on gasoline ethers and tertiary butyl alcohol in NHRSA 1460G:12	New Hampshire General Court	12 Months
<b>NEW JERSEY</b>			
	No Changes Required		
<b>NEW MEXICO</b>			
Biodiesel Blending Cap	Remove 5% biodiesel Cap from NMSA 57-19-29(c)	New Mexico Legislature	24 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>NEW YORK</b>			
Ethanol Blending Cap	Remove 10% Ethanol Blending Cap in 1 NYCRR Part 224.3(a)(2)(i)	New York Dept. of Agriculture	12 Months
Biodiesel Blending Restriction	Introduce specifications in 1 NYCRR Part 224.3(b) allowing for biodiesel blends to be sold that do not meet ASTM D975-05	New York Dept. of Agriculture	12 Months
<b>NORTH CAROLINA</b>			
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814 in 02 NCAC 42.0201(b)(1) to ethanol blends higher than E10	North Carolina Dept. of Agriculture and Consumer Services	12 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection (T V/L=20) exemption from ASTM D 4814 in NCAC 42.0201(b)(9) for ethanol blends higher than E10	North Carolina Dept. of Agriculture and Consumer Services	12 Months
Ethanol Blends T50 Minimum Offset	Extend T50 minimum offset from ASTM D4814 in 02 NCAC 42.0201(b)(4) for ethanol blends higher than E10	North Carolina Dept. of Agriculture and Consumer Services	12 Months
Biodiesel Blending Restriction	Modify definition and standards for “renewable diesel” blends (ASTM D975) in 02 NCAC 42 .0102(22) and 02 NCAC 42.0201(c)	North Carolina Dept. of Agriculture and Consumer Services	12 Months
<b>NORTH DAKOTA</b>			
Ethanol Blending Cap	Remove 10% ethanol blending limit in the definition of “gasohol” contained in NDCC 33-34-01-01	North Dakota Dept. of Health	12 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from in NDCC 33-34-01, Appendix “North Dakota Gasoline Specifications to ethanol blends higher than E10	North Dakota Dept. of Health	12 Months
<b>OHIO</b>			
	No Changes Required		

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>OKLAHOMA</b>			
Ethanol Blending Cap	Remove 10% ethanol cap in definition of “gasohol” contained in 165:15-1-2	Oklahoma Corporation Commission	12 Months
<b>OREGON</b>			
Ethanol Blending Cap	Remove 10% ethanol blending cap in OAR 603-027-0420(3)(b)	Oregon Dept. of Agriculture	12 Months
<b>PENNSYLVANIA</b>			
	No Changes Required		
<b>RHODE ISLAND</b>			
Ban on Ethers and Higher Alcohols	Eliminate Ban on Ethers and Higher Alcohols in Gasoline in General Laws Chapter 31-37-7.1.	Rhode Island General Assembly	24 Months
<b>SOUTH CAROLINA</b>			
	No Changes Required		
<b>SOUTH DAKOTA</b>			
	No Changes Required		
<b>TENNESSEE</b>			
Ethanol Blending Cap	Remove 10% ethanol blending cap in Rule 0080-5-12-.02(1)(c) and (d)	Tennessee Dept. of Agriculture	12 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814 in 0080-5-12-.02(1)(b) to blends higher than E10	Tennessee Dept. of Agriculture	12 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection standards (T V/L=20) in Rule 0080-5-12-.02(c)(1)(a)(1)(ii) to ethanol blends higher than E10.	Tennessee Dept. of Agriculture	12 Months
T50 Minimum Offset	Extend T50 minimum (T V/L=20) standard in Rule 0080-5-12-.02(c)(1)(a)(1)(i) to ethanol blends higher than E10.	Tennessee Dept. of Agriculture	12 Months
Biodiesel Blending Cap	Remove 20% biodiesel blending cap in Rule 0080-5-12-.02.	Tennessee Dept. of Agriculture	12 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>TEXAS</b>			
	No Changes Required		
<b>UTAH</b>			
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814 in UAC R70-940-2(C)(2) to blends higher than E10	Utah Dept. of Agriculture and Food	12 Months
<b>VERMONT</b>			
Ban on Ethers	Eliminate the ban on “gasoline ethers” in Section 1.10, V.S.A 577	Vermont General Assembly	24 Months
<b>VIRGINIA</b>			
Ethanol Blending Cap	1. Remove the 10% ethanol blending cap contained in NIST Handbook 130, Section 2.1.2, adopted by reference in VC §59.1-153 2. Remove the 10% ethanol blending cap contained in 2VAC5-420-30(A)	1. Virginia Legislature 2. Virginia Dept. of Agriculture and Consumer Services	24 Months
Ethanol Blends Vapor Pressure Offset	1. Extend 1 psi vapor pressure offset contained in the NIST Handbook 130, Section 2.1.3(a), adopted by reference by VC §59.1-153, to blends higher than E10 2. Extend 1 psi vapor pressure offset in 2VAC5-420-30(B) to ethanol blends higher than E10	1. Virginia Legislature 2. Virginia Dept. of Agriculture and Consumer Services	24 Months
Ethanol Blends T50 Minimum Offset	1. Extend T50 offset contained in the NIST Handbook 130, Section 2.1.3(b), adopted by reference by VC §59.1-153 to blends higher than E10 2. Extend T50 minimum offset in 2VAC5-420-30(A)(1)(a) to blends higher than E10	1. Virginia Legislature 2. Virginia Dept. of Agriculture and Consumer Services	12 Months
Ethanol Blends Vapor Lock Protection Offset	1. Extend vapor lock protection (T V/L=20) offset contained in the NIST Handbook 130, Section 2.1.3(c), adopted by reference by VC §59.1-153 to blends higher than E10 2. Extend vapor lock protection (T V/L=20) waiver contained 2VAC5-420-30(A)(1)(b) to blends higher than E10	1. Virginia Legislature 2. Virginia Dept. of Agriculture and Consumer Services	12 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
Biodiesel Blending Restriction	Introduce biodiesel standards into 2VAC5-420-30 allowing biodiesel blends to be sold	Virginia Dept. of Agriculture and Consumer Services	12 Months
<b>WASHINGTON</b>			
Ethanol Blending Cap	Remove the 10% ethanol blending cap contained in NIST Handbook 130, Section 2.1.2 in proposed revisions to Chapter 16-662 WAC	Washington Dept. of Agriculture	24 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset contained in the NIST Handbook 130, Section 2.1.3(a) in proposed revisions to Chapter 16-662 WAC to blends higher than E10	Washington Dept. of Agriculture	24 Months
Ethanol Blends T50 Minimum Offset	Extend T50 offset contained in the NIST Handbook 130, Section 2.1.3(b) in proposed revisions to Chapter 16-662 WAC to blends higher than E10	Washington Dept. of Agriculture	24 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection (T V/L=20) offset contained in the NIST Handbook 130, Section 2.1.3(c) in proposed revisions to Chapter 16-662 WAC to blends higher than E10	Washington Dept. of Agriculture	24 Months
<b>WEST VIRGINIA</b>			
Ethanol Blending Cap	Remove the 10% ethanol blending cap contained in NIST Handbook 130, Section 2.1.2, adopted by reference in WVC §47-1-11	West Virginia Legislature	24 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset contained in the NIST Handbook 130, Section 2.1.3(a), adopted by reference by WVC §47-1-11, to blends higher than E10	West Virginia Legislature	24 Months
Ethanol Blends T50 Minimum Offset	Extend T50 offset contained in the NIST Handbook 130, Section 2.1.3(b), adopted by reference by WVC §47-1-11, to blends higher than E10	West Virginia Legislature	24 Months
Ethanol Blends Vapor Lock Protection Offset	Extend vapor lock protection (T V/L=20) offset contained in the NIST Handbook 130, Section 2.1.3(c), adopted by reference by WVC §47-1-11, to blends higher than E10	West Virginia Legislature	24 Months

Summary of Changes Required in Order for E15 and Other New Transportation Fuels to be Introduced into Commerce			
Regulations Pertaining to:	Specific Change Required	Responsible Agency	Time Required
<b>WISCONSIN</b>			
Ethanol Blending Cap	Remove the 10% ethanol blending cap contained in WAC 48.500(d)(2)	Wisconsin Dept. of Commerce	24 Months
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814, adopted by reference in WAC 48.500(c), to blends higher than E10	Wisconsin Dept. of Commerce	24 Months
<b>WYOMING</b>			
Ethanol Blends Vapor Pressure Offset	Extend 1 psi vapor pressure offset from ASTM D4814, adopted by reference in Wyoming Regulations Chapter 52 Section 4(c), to blends higher than E10	Wyoming Dept. of Agriculture	12 Months
Biodiesel Blending Cap	Introduce specifications in Wyoming Regulations Chapter 52 Section 4(c) to allow biodiesel blends to be sold that are not covered by an ASTM standard (i.e., B21-B99)	Wyoming Dept. of Agriculture	12 Months

## Appendix B

### Regulatory Applicability Matrix for E10+ and Biodiesel



### Regulatory Applicability Matrix for E10+ and Biodiesel

<div style="writing-mode: vertical-rl; transform: rotate(180deg);">REG/CODE</div> EQUIPMENT	OSHA	NFPA 30	NFPA 30A	CA SWRCB	40 CFR 280	IFC	OTHERS
<b>Dispensing Equipment</b>	E10+ (L) <sup>1</sup>	E10+/Biodiesel (L – Flexible Connectors Only) <sup>4</sup>	E10+/Biodiesel (L, A) <sup>7</sup>	n/a	n/a	≤E15/Biodiesel (L, ES, A) <sup>14</sup> >E15 (L, ES, A) <sup>15</sup>	NCWM (A)
<b>UST</b>	E10+/Biodiesel (ES, C) <sup>2</sup>	E10+/Biodiesel (L, ES, C) <sup>5</sup>	E10+/Biodiesel (L, ES, C) <sup>8</sup>	E10+/Biodiesel (L, ES, C, W) <sup>12</sup>	E10+/Biodiesel (ES, C) <sup>13</sup>	E10+/Biodiesel (L, ES, C, A) <sup>16</sup>	n/a
<b>Piping</b>	E10+/Biodiesel (ES) <sup>3</sup>	E10+/Biodiesel (L, ES, C) <sup>6</sup>	E10+/Biodiesel (L, ES, C) <sup>9</sup>	E10+/Biodiesel (L, ES, C, W) <sup>12</sup>	E10+/Biodiesel (ES, C) <sup>13</sup>	E10+/Biodiesel (L, ES, C, A) <sup>17</sup>	n/a
<b>Release Detection Equipment</b>	n/a	n/a	E10+/Biodiesel (L) <sup>10</sup>	Biodiesel (VPH – C) <sup>12</sup>	E10+/Biodiesel (ES, C) <sup>13</sup>	E10+/Biodiesel (L, A) <sup>18</sup>	TCEQ (A)
<b>Vapor Recovery Equipment</b>	n/a	n/a	E10+/Biodiesel (L) <sup>11</sup>	n/a	E10+/Biodiesel (ES, C) <sup>13</sup>	≤E15/Biodiesel (L) <sup>19</sup> >E15 (L or A) <sup>15</sup>	CARB, TCEQ, MOTEP (A)

Key:

**L** – Listing Requirement, **ES** – Good/Recognized Engineering Standards Requirement, **C** – Compatibility Requirement, **W** – Warranty/Manufacturer Certification, **A** – Approval Requirement. (National Conference on Weights and Measures (NCWM), California Air Resources Board (CARB), Texas Council on Environmental Quality (TCEQ), and Missouri Performance Evaluation Testing Procedures (MOPETP))

Notes:

<sup>1</sup> OSHA 1910.106(g)(3)(iv)(b)(1) – Only listed devices may be used for dispensing Class I liquids.

<sup>2</sup> OSHA 1910.106(b)(1)(i)(c) – Tanks built of materials other than steel shall be designed to specs embodying principles recognized as good engineering design for the material used.

OSHA 1910.106(b)(1)(iii)(a) – Atmospheric tanks shall be built in accordance with acceptable good standards of design. Atmospheric tanks may be built in accordance with the following consensus standards that are incorporated by reference as specified in 1910.6.

(1) Underwriters' Laboratories, Inc., Subjects No. 142, Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids, 1968; No. 58, Standard for Steel Underground Tanks for Flammable and Combustible Liquids, Fifth Edition, December 1961; or No. 80, Standard for Steel Inside Tanks for Oil-Burner Fuel, September 1963.

<sup>3</sup> OSHA 1910.106(c)(2)(ii) – Materials for piping, valves, and fittings - Material other than steel, nodular iron, or malleable iron shall be designed to specifications embodying principles recognized as good engineering practices for the material used.

**NOTE:** OSHA 1910.307(c)(2)(i) – [Electrical] Equipment shall be approved not only for class of location, but also for the ignitable or combustible properties of the specific gas, vapor, dust, or fiber that will be present.

<sup>4</sup> NFPA 30 Chap. 18.3.7 – Listed flexible connectors shall be permitted to be used where vibration exists.

<sup>5</sup> NFPA 30 Chap. 21.4.1.1 – Tanks and their appurtenances must be made of materials compatible with liquid to be stored. Any doubts about the properties of the liquid to be stored shall be referred to supplier, producer, or other competent authority of the liquid.

NFPA 30 Chap. 21.4.2.1.1 – Atmospheric tanks shall be designed and constructed in accordance with recognized engineering standards.

Atmospheric tanks that meet any of the following standards shall be deemed as meeting the requirements of 21.4.2.1:  
API Spec 12B, *Bolted Tanks for Storage of Production Liquids*; API Spec 12D, *Field Welded Tanks for Storage of Production Liquids*; API Spec 12F, *Shop Welded Tanks for Storage of Production Liquids*; API Standard 650, *Welded Steel Tanks for Oil Storage*; UL 58, *Standard for Steel Underground Tanks for Flammable and Combustible Liquids*; ANSI/UL 80, *Standard for Steel Inside Tanks for Oil Burner Fuel*; ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*; ANSI/UL 1316, *Standard for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures*; ANSI/UL 1746, *Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks*; UL 2080, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*; and ANSI/UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*.

NFPA 30 Chap. 21.5.1 – All tanks...shall be tested before they are placed in service in accordance with the requirements of the code under which they were built.

NFPA 30 Chap. 21.5.1.1 – An approved listing mark on a tank shall be considered to be evidence of compliance with this requirement.

<sup>6</sup> NFPA 30 Chap. 27.4.4.2 – Piping materials chosen shall be compatible with the liquids being handled.

NFPA 30 Chap. 27.4.4.3 – Piping systems of [low melting point materials] shall be designed and built in accordance with recognized standards of design for the particular materials chosen or with approved equivalent standards or shall be listed.

<sup>7</sup> NFPA 30A Chap. 6.3.2 – Dispensing devices for Class I and II liquids shall be listed.

*Other Relevant NFPA 30A dispensing requirements:*

6.3.2.1 – Listed dispensing devices may be modified provided that the modifications are “listed by report” by an approved testing laboratory or by an AHJ.

6.3.9 – Where liquid is supplied to the dispensing device under pressure, a listed...emergency shutoff valve...shall be installed.

6.3.10 – Where a suction-type dispensing system...produces a gravity head...a listed, vacuum-actuated shutoff valve...shall be installed.

6.5.1 & 6.5.2 – Listed hose assemblies and emergency breakaway devices must be used to dispense fuel.

6.6.1 – Nozzle valves listed in accordance with UL842 must be used to dispense Class I & II liquids.

6.6.3 – Over-head dispensing devices must use a listed, automatic-closing-type hose nozzle valve.

6.8.1 & 6.8.2 – Dispensing devices and hose nozzle valves on vapor recovery systems must be listed.

<sup>8</sup> NFPA 30A Chap. 4.3.1 – USTs shall meet all applicable requirements of Chapters 21 through 23 and 27 of NFPA 30. (See note 4)

<sup>9</sup> NFPA 30A Chap. 5.2.1 – Design, fabrication, assembly, test, and inspection of the piping system shall meet the requirements of Chap. 27 of NFPA 30. (see note 5)

<sup>10</sup> NFPA 30A Chap. 5.4.4 – On remote pressure pumping systems, each pump shall have installed...a listed leak detection device that will provide an...indication if the piping and dispensing devices are not liquidtight.

NFPA 30A Chap. 6.4.2 – Each pump shall have installed...a listed leak detection device that will provide an...indication if the piping of dispenser is leaking.

<sup>11</sup> NFPA 30A Chap. 6.8.1 – Dispensing devices that incorporate vapor recovery shall be listed.

NFPA 30A Chap. 6.8.2 – Hose nozzle valves used on vapor recovery systems shall be listed for the purpose.

NFPA 30A Chap. 10.1.1 – Vapor processing system components, including hose nozzle valves, blowers, vacuum pumps, flame arresters, or systems for preventing flame propagation, controls, and vapor processing equipment shall be individually listed for their intended use.

<sup>12</sup> CCR 23.3.16.2631(b) – The design and construction of all primary containment including any integral secondary containment system, shall be approved by an independent testing organization in accordance with industry codes, voluntary consensus standards, or engineering standards. All other components used to construct the primary containment system, such as special accessories, fittings, coatings or linings, monitoring systems and level controls shall also be approved by an independent testing organization. This requirement became effective on July 1, 1991 for underground storage tanks; January 1, 1992 for piping; and shall be effective on January 1, 1995 for all other components. The exterior surface of underground storage tanks shall bear a marking, code stamp, or label showing the following minimum information: (1) Engineering standard used.

CCR 23.3.16.2631(d) – A secondary containment system which is not an integral part of primary containment shall be designed and constructed according to an engineering specification approved by a state registered professional engineer or according to a nationally recognized industry code or engineering standard. The engineering specification shall include the construction procedures. Materials used to construct the secondary containment system shall have sufficient thickness, density, and corrosion resistance to prevent structural weakening or damage to the secondary containment system as a result of contact with any released hazardous substance.

CCR 23.3.16.2631(d)(6) – Secondary containment systems using membrane liners shall be approved by an independent testing organization in accordance with industry codes, voluntary consensus standards, or engineering standards.

CCR 23.3.16.2631(d)(7) – A membrane liner, if used, shall be installed under the direct supervision of a representative of the membrane liner fabricator or a contractor certified by the fabricator.

California State Water Resources Control Board: BIODIESEL UPDATE: UL POSITION ON B5 (01.09.09)

<sup>13</sup> 40 CFR 280.32 – Owners and operators must use an UST system made of or lined with materials that are compatible with the substance being stored in the UST system. Note: Owners and operators storing alcohol blends may use the following codes to comply with the requirements of this section: API Pub. 1626, *Storing and Handling Ethanol and Gasoline-Ethanol Blends at Distribution Terminals and Service Stations*; API Pub. 1627, *Storage and Handling of Gasoline-Methanol/Cosolvent Blends at Distribution Terminals and Service Stations*.

40 CFR 280.12 – *UST System or Tank System* means an underground storage tank, connected underground piping, underground ancillary equipment, and containment system, if any.

40 CFR 280.12 – *Ancillary Equipment* means any devices including, but not limited to, such devices as piping, fittings, flanges, valves, and pumps used to distribute, meter, or control the flow of regulated substances to and from a UST. (EPA confirms that this definition includes leak detection equipment.)

- 40 CFR 280.20(a&b) – Tanks and piping must be designed, constructed and protected from corrosion in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory.
- 40 CFR 280.43(g)(2) – For UST systems with a secondary barrier within the excavation zone, the sampling or testing method used can detect a release between the UST system and the secondary barrier: (ii) The barrier is compatible with the regulated substance stored so that a release from the UST system will not cause a deterioration of the barrier allowing a release to pass through undetected.
- 40 CFR 280.43(g)(3) – For tanks with an internally fitted liner, an automated device can detect a release between the inner wall of the tank and the liner, and the liner is compatible with the substance stored.
- <sup>14</sup> IFC 2206.7.1 – Electrical equipments, dispensers, hose, nozzles and submersible or subsurface pumps used in fuel-dispensing systems shall be listed.
- IFC 2206.7.5 – Dispenser hoses shall be listed and approved.
- IFC 2206.7.5.1 – Dispenser hoses for Class I and II liquids shall be equipped with a listed emergency breakaway device.
- IFC 2206.7.6 – A listed automatic-closing-type hose nozzle valve...shall be provided on island-type dispensers used for dispensing Class I, II, or IIIA liquids.
- IFC 2206.7.9.1.1 – Dispensing devices incorporating provisions for vapor recovery shall be listed and labeled. When existing listed or labeled dispensing devices are modified for vapor recovery, such modifications shall be listed by report by a nationally recognized testing laboratory.
- IFC 2705.1.11 – Systems shall be suitable for the use intended and shall be designed by persons competent in such design.
- IFC 3405.2 – Liquid transfer equipment and methods for transfer of Class I, II, IIIA liquids shall be approved.
- IFC 3405.2.3 – Piping, hoses and valves used in liquid transfer operations shall be approved or listed for the intended use.
- <sup>15</sup> IFC 2206.8.1 – Dispensers, hoses, nozzles, breakaway fittings, swivels, flexible connectors or dispenser emergency shutoff valves, vapor recovery systems and pumps used in alcohol blended fuel-dispensing systems shall be listed or approved for the specific purpose.
- IFC 2705.1.11 – Systems shall be suitable for the use intended and shall be designed by persons competent in such design.
- IFC 3405.2 – Liquid transfer equipment and methods for transfer of Class I, II, IIIA liquids shall be approved.
- IFC 3405.2.3 – Piping, hoses and valves used in liquid transfer operations shall be approved or listed for the intended use.
- <sup>16</sup> IFC 2703.2.1 – Containers, cylinders, tanks, and other means used for containment of hazardous materials shall be of an approved type.
- IFC 3404.2.7 – The design, fabrication, and construction of tanks shall comply with NFPA 30.
- IFC 3404.2.11.1 – Underground tanks shall not contain petroleum products containing mixtures of a nonpetroleum nature, such as ethanol or methanol blends, without evidence of compatibility.
- <sup>17</sup> IFC 2703.2.2 – Piping, tubing valves and fittings conveying hazardous materials shall be designed and installed in accordance with approved standards.
- IFC 2703.2.2.1 – Piping, tubing, valves, fittings and related components shall be designed and fabricated from materials that are compatible with the material to be contained.
- IFC 3403.6.2 – Piping system components shall be designed and fabricated in accordance with the applicable standard listed in Table 3403.6.2 [ASME B31, *Code for Pressure Piping*] and Chapter 27 of NFPA 30, except as modified by Section 3403.6.2.1.
- IFC 3403.6.9 – Flexible joints shall be listed and approved.
- IFC 3403.6.10 – Nonmetallic joints shall be approved and shall be installed in accordance with the manufacturer's instructions.
- IFC 3405.2.3 – Piping, hoses and valves used in liquid transfer operations shall be approved or listed for the intended use.

- <sup>18</sup> IFC 2206.7.7.1 – Where remote pumps are used to supply fuel dispensers, each pump shall have installed...a listed leak detection device that will detect a leak in the piping and dispensers and provide an indication.
- IFC 2703.2.3 – Equipment, machinery and required detection and alarm systems associated with the use, storage or handling of hazardous materials shall be listed or approved.
- IFC 2704.2.2.5 – An approved monitoring method shall be provided to detect hazardous materials in the secondary containment system. Where monitoring devices are provided, they shall be connected to approved visual or audible alarms.
- IFC 3404.2.11.5.2 – Underground storage tank systems shall be provided with an approved method of leak detection from any component of the system that is designed and installed in accordance with NFPA 30.
- <sup>19</sup> IFC 2206.7.9.1.1 – Dispensing devices incorporating provisions for vapor recovery shall be listed and labeled. When existing listed or labeled dispensing devices are modified for vapor recovery, such modifications shall be listed by report by a nationally recognized testing laboratory.
- IFC 2206.7.9.2.1 – Equipment in vapor-processing systems, including hose nozzle valves, vapor pumps, flame arresters, fire checks or systems for prevention of flame propagation, controls and vapor-processing equipment, shall be individually listed for the intended use in a specified manner. Vapor-processing systems that introduce air into the underground piping or storage tanks shall be provided with equipment for prevention of flame propagation that has been tested and listed as suitable for the intended use.
- IFC 3405.2.3 – Piping, hoses and valves used in liquid transfer operations shall be approved or listed for the intended use.

IFC Definition of “labeled” – Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

IFC Definition of “listed” – Equipment, materials, products or services included in a list published by an organization acceptable to the fire code official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

IFC Definition of “approved” – Acceptable to the fire code official (The fire chief or other designated authority charged with the administration and enforcement of the code, or a duly authorized representative.)

IFC Definition of “alcohol blended fuels” – Alcohol blended fuels, including those containing 85-percent ethanol and 15-percent unleaded gasoline (E85), are flammable liquids consisting of ethanol or other alcohols blended greater than 15 percent by volume.

### Industry Practices Applicability Matrix for E10+ and Biodiesel

<u>Equipment</u> <u>Recommended Practice</u>	<b>API RP (1615)</b>	<b>PEI RP 100</b>	<b>PEI RP 300</b>
<b>Dispensing Equipment</b>	n/a	n/a	n/a
<b>UST</b>	E10+/Biodiesel <sup>1</sup> (W, C)	E10+/Biodiesel <sup>5</sup> (A)	n/a
<b>Piping</b>	E10+/Biodiesel <sup>2</sup> (W, C, L)	E10+/Biodiesel <sup>6</sup> (L, C)	E10+/Biodiesel <sup>8</sup> (L, C)
<b>Release Detection Equipment</b>	E10+/Biodiesel <sup>3</sup> (C)	E10+/Biodiesel <sup>7</sup> (W)	n/a
<b>Vapor Recovery Equipment</b>	E10+/Biodiesel <sup>4</sup> (A)	n/a	E10+/Biodiesel <sup>9</sup> (L, C)

Notes:

<sup>1</sup> API RP 1615 Chap. 3.3.2 – If using FRP tanks/piping, manufacturer should certify that the equipment is safe for use with the product/additives to be handled. Product compatibility should also be confirmed for materials other than FRP, especially when using alternative/oxygenated fuels.

<sup>2</sup> API RP 1615 Chap. 9.4.1 – Any FRP pipe used in a USTS should be listed for the products to be stored including alcohol/gasoline mixtures.

API RP 1615 Chap. 9.6.2 – Any flexible pipe used in a USTS should be listed for the products to be stored including alcohol/gasoline mixtures.

- <sup>3</sup> API RP 1615 Chap. 8.7.2 – Line Leak Detectors – Note: Different fuels have different physical properties and should be considered when selecting specific equipment for line leak detectors.
- <sup>4</sup> API RP 1615 Chap. 12.1.1 – The use of vapor recovery systems is required in some areas of the United States...The authority having jurisdiction should be consulted for specific requirements.
- <sup>5</sup> PEI RP 100 Chap. 1.9 – Ensure that the equipment to be installed meets all applicable regulatory requirements before beginning an installation. Consult the local authority having jurisdiction before storage-system plans are finalized or construction is initiated. Approvals may also be required from building-code officials, environmental agencies, zoning boards, fire marshals, or similar authorities.
- <sup>6</sup> PEI RP 100 Chap. 10.2 – All piping components, including fittings, gaskets, o-rings, pipe dope, and the piping itself, must: be fully compatible with the products stored.
- PEI RP 100 Chap. 10.6 – Flexible connectors installed in dispenser or intermediate sumps should be listed for aboveground use. Flexible connectors installed in tank-top sumps may be listed for underground or aboveground use.
- <sup>7</sup> PEI RP 100 Chap. 9.3.1 – Automatic Line-Leak Detectors – Consult the manufacturer’s certification of performance data to determine applicability of line-leak detectors to specific installations. Factors to be considered include type of fuel...
- <sup>8</sup> PEI RP 300 Chap. 6.2 – If used, flexible connectors should be listed specifically for aboveground use...All [Aboveground Vapor] piping components, including fittings, flange gaskets, pipe dope and the piping itself, must be compatible with the products stored.
- <sup>9</sup> PEI RP 300 Chap. 7.2 – [Underground Vapor] Piping should be listed for the intended use...All piping components, including fittings, flange gaskets, pipe dope and the piping itself, must be compatible with the products stored.

#### **REFERENCES:**

OSHA 1910

NFPA 30 - FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE

NFPA 30A – CODE FOR MOTOR FUEL DISPENSING FACILITIES AND REPAIR GARAGES

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD - BIODIESEL UPDATE

40 CFR – CODE OF FEDERAL REGULATIONS

IFC – INTERNATIONAL FIRE CODE

API 1615 – INSTALLATION OF UNDERGROUND PETROLEUM STORAGE SYSTEMS

API 1626 – STORING AND HANDLING ETHANOL AND GASOLINE-ETHANOL BLENDS AT TERMINALS AND SERVICE STATIONS

API 1627 – STORAGE AND HANDLING OF GASOLINE-METHANOL/COSOLVENT BLENDS AT DISTRIBUTION TERMINALS AND SERVICE STATIONS

API 1631 – INTERIOR LINING AND PERIODIC INSPECTION OF UNDERGROUND STORAGE TANKS

PEI / RP 100 – RECOMMENDED PRACTICES FOR INSTALLATION OF UNDERGROUND LIQUID STORAGE SYSTEMS

PEI / RP 300 – RECOMMENDED PRACTICES FOR INSTALLATION AND TESTING OF VAPOR-RECOVERY SYSTEMS AT VEHICLE FUELING SITES