State of California
AIR RESOURCES BOARD

STAFF REPORT:
INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING, PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE REGULATIONS FOR GASOLINE AND DIESEL FUEL TEST METHODS

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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Section I - Executive Summary

The Air Resources Board (ARB or Board) staff is proposing to amend the California Reformulated Gasoline (CaRFG) and California Diesel Fuel (CDF) regulations to incorporate new test methods. Over the years, the Board has approved changes to fuel test methods when: new fuel specifications are added to the regulations; improved test methods are developed; and improved versions of existing methods are published. No changes are being proposed to the actual specifications for CaRFG or CDF.

In December 2003, CaRFG Phase 3 (CaRFG3) regulations took effect. These regulations prohibited the use of methyl *tert*-butyl ether (MTBE) and all other oxygenates aside from ethanol unless a multimedia evaluation allows for an alternative, and also provided specifications for certain chemical properties of denatured ethanol intended for blending with California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB) (including benzene, total aromatic compounds, and olefins). At the time, no test methods capable of measuring MTBE and other oxygenates at the levels specified by the CaRFG regulations existed. In addition, there were no test methods for adequately and directly measuring the specified chemical properties of denatured ethanol at these levels.

New test methods for measuring these properties have been developed, accepted, and published. ARB staff has actively participated in the development of these new methods. Thus, staff is proposing the incorporation of these new test methods to enable enforcement of the CaRFG regulations and to provide the means for fuel producers, blenders, and shippers to more accurately determine whether their fuels comply with the regulations.

Additionally, ARB staff is proposing to update several existing fuel test methods to their most recent versions. Test methods published by ASTM International (formerly the American Society for Testing and Materials) are updated at least once every five years to: correct miscellaneous errors; reflect newer instrumentation and procedures; provide clarification or new information; or incorporate data from new studies. Adopting these new versions will benefit clean air in California by ensuring that ARB enforcement and other stakeholders can use the best test procedures available.

Staff has held meetings with the Western States Petroleum Association (WSPA) twice per year for the last nine years to discuss these and other fuel test method issues. Additionally, in developing this proposal, staff conducted a public workshop on July 11, 2012.

Staff has determined that incorporation of the proposed new and updated test methods would not result in any potentially significant adverse impacts on the environment, because these are test methods that only improve laboratory analyses and do not add or remove any ingredient from gasoline or diesel fuel.

The gasoline and diesel fuel regulations do not require producers, blenders, or shippers to test their product. If the stakeholders choose to voluntarily test using the

proposed new and updated test methods, staff estimates the cost of complying with the amended regulations at $1.2 - $7.7 million over five years, or approximately 0.002 – 0.012 cents per gallon of gasoline produced. The cost increase would result primarily from acquisition of upgraded analytical instruments. As a result, staff expects no significant change in employment, business competitiveness, or the status of businesses in California due to the proposed change of test methods.

Section II – Introduction and Background

A. Introduction

This report presents the Initial Statement of Reasons (ISOR) in support of proposed amendments to the California Reformulated Gasoline (CaRFG) and California Diesel Fuel (CDF) regulations. The staff of the Air Resources Board (ARB or Board) is proposing to add new test methods to the fuel regulations and to update several existing methods to their most recent versions. These new and updated test methods will be used to determine motor vehicle fuel compliance with ARB's fuel regulations. No changes are being proposed to the actual specifications for CaRFG or CDF.

Monitoring for compliance with fuel specifications promulgated in ARB's CaRFG and CDF regulations is essential for air quality. ARB staff conducts regular week-long fuel inspections, which involve the following steps:

- ARB's Mobile Laboratory is moved to the vicinity of the inspection.
- ARB inspectors obtain samples from refineries, terminals, ports, and service stations without advance notice (Figure A).
- Samples are brought back to the Mobile Laboratory (Figures B and C) and analyzed the same day.
- Analytical results are checked for potential violations. If any are found, the fuel is resampled and reanalyzed the same day or the next day.
- Violating fuels are removed from the marketplace immediately, minimizing any excess air emissions.
- Confirmed violations are referred to ARB legal staff.

In addition to the above inspections, fuel samples are regularly delivered to ARB's El Monte laboratory for analysis.

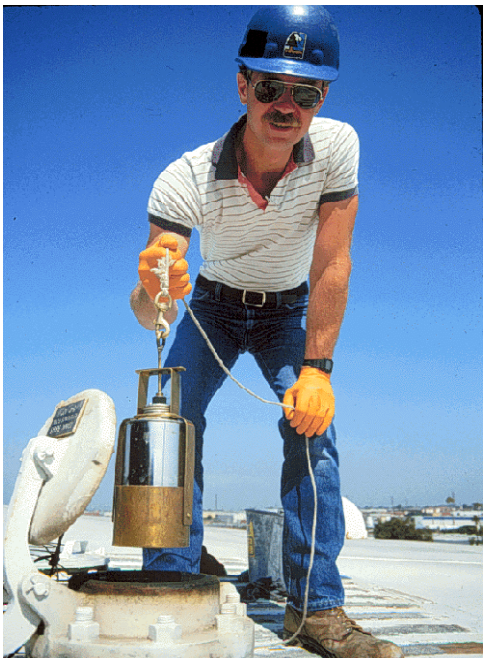

Figure A. ARB staff collecting a fuel sample.

Figure B. Mobile Laboratory exterior

Figure C: Mobile Laboratory interior

B. Legal Requirements

Health and Safety Code (H&SC) section 43013 requires ARB to adopt and implement motor vehicle fuel specifications for the control of air contaminants and sources of air pollution. As the result of the presence of methyl *tert*-butyl ether (MTBE) in groundwater, on March 25, 1999, California's Governor issued Executive Order D-5-99. The Executive Order directed the phase-out of MTBE in California's gasoline. The phase-out of MTBE left ethanol as the only oxygenate allowed to be used in California gasoline. H&SC section 43018 requires ARB to achieve the maximum emission feasible reductions from motor vehicles and motor vehicle fuels. In carrying out this requirement, ARB adopts standards and regulations that produce the most cost-effective combination of control measures on all classes of motor vehicles and motor vehicle fuels, including the specification of vehicular fuel composition. In response, the Board has adopted numerous regulations, including the CaRFG program.

C. California Gasoline Regulations

The CaRFG program is a vital part of ARB's strategy to address motor vehicles and fuels as a system by combining cleaner fuels and motor vehicle controls to achieve the maximum emission reductions at the lowest cost. CaRFG also substantially reduced emissions from existing vehicles. The Board initially adopted the CaRFG program in two phases. Phase 1 of the program required changes to gasoline that could be made in a short time frame and only required small adjustments by producers and importers. Phase 2 was significantly more complex and achieved more emissions reductions.

The Board adopted CaRFG3 regulations in December 1999, taking effect in December 2003. The primary change implemented in CaRFG3 was the prohibition of MTBE and all other oxygenates except ethanol unless a multimedia evaluation was conducted and the California Environmental Policy Council determined that use of an alternative will not cause a significant adverse impact on the public health or the environment. In general, oxygenates such as MTBE and ethanol are used in gasoline to reduce the exhaust emissions of hydrocarbons and carbon monoxide and improve the octane rating. However, as a result of the presence of MTBE in groundwater, California's Governor issued Executive Order D-5-99, directing the phase-out of MTBE in California's gasoline. CaRFG3 added specifications for allowable levels of MTBE and other prohibited oxygenates.

In November 2000, the Board adopted follow-up amendments to CaRFG3 regulations which, among other things, adopted specifications for denatured ethanol intended for blending with CARBOB. Denatured ethanol is ethanol to which a substance has been added to discourage human ingestion. These specifications imposed limits on the sulfur, benzene, olefins, aromatic hydrocarbon, ethanol, methanol, solvent-washed gum, water, denaturant, inorganic chloride, and copper content, as well as limits on the acidity, pHe, and appearance of the denatured ethanol.

In June 2007, the Board adopted amendments, which among other things, lowered the sulfur cap limit from 30 parts per million by weight (ppmw) to 20 ppmw.

Currently, the maximum allowable level of MTBE in California gasoline is 0.05 volume percent, and the maximum allowable oxygen level from all other prohibited oxygenates in gasoline is 0.06 weight percent. The test method currently specified in the CaRFG regulations is not capable of accurately measuring such low levels of oxygenates, and therefore neither ARB nor stakeholders have the means to accurately determine whether a CARBOB or a blend of California gasoline meets these regulatory requirements.

The specifications for denatured ethanol adopted in CaRFG3 regulations include, among others, limits on the allowable concentrations of benzene, total aromatic hydrocarbons, and olefins. These classes of compounds do not exist naturally in ethanol. Their presence is due to the addition of the denaturant, which is typically gasoline. Since no ASTM test methods for adequately measuring these compounds in denatured ethanol existed at the time, the regulations state that compliance is to

be determined by analyzing the denaturant before it is blended into the pure ethanol. The vast majority of denatured ethanol used in California is produced outside the state, and as a result, ARB had no opportunity to analyze the denaturant in order to determine whether the resulting denatured ethanol used in California meets these specifications. Additionally, stakeholders such as terminal operators and fuel blenders have no way to check whether the denatured ethanol they use meets the state's requirements.

D. California Diesel Regulations

In November 1988, ARB approved regulations limiting, among other things, the allowable sulfur content of motor vehicle diesel fuel to 500 parts per million by weight (ppmw) statewide. ASTM method D2622-94 was specified as the test method for measuring the sulfur content in diesel fuel. These diesel fuel regulations, which became effective in 1993, are a necessary part of the state's strategy to reduce air pollution through the use of clean fuels and lower emitting motor vehicles and off-road equipment.

CDF regulations have resulted in significant reductions in emissions from diesel powered vehicles and equipment of sulfur dioxide (SO_2), particulate matter, and oxides of nitrogen (NO_X). California diesel fuel also results in reductions of emissions of several toxic substances, including benzene and polynuclear aromatic hydrocarbons.

In 2004, the Board adopted amendments to CDF, phasing in a new sulfur limit of 15 ppm and requiring the use of ASTM Test Method D 5453-93 or any other test method determined by the ARB Executive Officer to yield equivalent results.

E. Problems

1. Analysis of denatured ethanol in California gasoline

   At the time of the development of CaRFG3 regulations, no ASTM test methods for adequately measuring benzene, aromatic hydrocarbons, and olefins in denatured ethanol existed. As a result the regulations provided that compliance is to be determined by analyzing the denaturant before it is blended into the pure ethanol. However, since the vast majority of denatured ethanol used in California is produced outside the state, ARB and downstream stakeholders do not typically have access to the denaturants used in the production of denatured ethanol sold in California. As a result, neither ARB nor gasoline blenders can check the denatured ethanol for compliance with these specifications.

2. Analysis of MTBE and other prohibited oxygenates in California gasoline

   The test method currently specified in CaRFG regulations to measure MTBE and other prohibited oxygenates is ASTM D4815-04. However, this method is not capable of accurately measuring low levels of these species. Therefore neither ARB nor stakeholders have the means to accurately determine whether a CARBOB or a blend of California gasoline meets these regulatory requirements.

3. California-specific information for testing olefins in California gasoline

CaRFG regulations currently specify the use of ASTM D6550-00 to determine the olefin content in California gasoline. Additional California-specific information is presently included in the footnotes to the test methods table in section 2263(b). This information relates to the calculation of reproducibility, conversion from mass percent to volume percent olefin, and the range of applicability. Therefore, the analyst must rely on two documents, the ASTM method and the CaRFG regulations, to properly calculate the olefin content in California gasoline. This results in additional inconvenience and confusion to the analyst and is no longer necessary.

4. Analysis of permitted oxygenates in California gasoline

CaRFG regulations currently specify the use of ASTM D4815-04 to determine the ethanol content in California gasoline. However, this method includes minor errors that could cause confusion for analysts learning the method.

5. Analysis of benzene and aromatic hydrocarbons in California gasoline

CaRFG regulations currently specify the use of ASTM D5580-00 and include, in the footnotes to the test methods table in section 2263(b), formulas to determine reproducibility of benzene and total aromatic hydrocarbons. The analyst must rely on two documents, the ASTM method and the CaRFG regulations, to properly calculate reproducibility, resulting in additional inconvenience. The formulas published in ASTM D5580-02(2007) are more appropriate.

6. Analysis of sulfur in California gasoline

Section 2263(b) currently specifies both ASTM D2622-94 and ASTM D5453-93 for the measurement of sulfur in California gasoline. However, ASTM D2622-94 has a limit of quantification of 10 ppm sulfur, which is higher than the levels currently observed in most California gasoline blends. Therefore, ASTM D2622-94 is no longer appropriate for measuring sulfur in California gasoline.

7. Analysis of aromatic hydrocarbons and polycyclic aromatic hydrocarbons in California diesel fuel

CDF regulations currently specify the use of ASTM D5186-96 for the measurement of aromatic hydrocarbons and polycyclic aromatic hydrocarbons in California diesel fuel. The quality control (QC) section of this method requires that laboratories, which analyze a wide variety of diesel fuels, run several different QC samples each day. This can be time-consuming for the analyst.

F. Purpose, Benefits, and Goals of the Regulation

As discussed above in Section II.B., ARB is required to adopt and implement motor vehicle fuel specifications for the control of air contaminants and sources of air

pollution, to eliminate MTBE from California gasoline, and to achieve the maximum feasible reductions from motor vehicles and motor vehicle fuels.

G. Purpose and Benefits of the Amendments

The primary purpose of the proposed amendments is to enable ARB and stakeholders to adequately measure the chemical properties of CaRFG and denatured ethanol to determine their compliance with ARB's fuel regulations. This goal is accomplished by the addition of new test methods to the regulations.

Staff is also proposing to update the regulations for CaRFG and CDF to specify the use of current versions of other existing test methods. The newer versions correct errors, provide additional information, and streamline test procedures.

Staff is also proposing to remove one obsolete CaRFG test method for future analyses. This method is not sufficiently sensitive for California gasoline blends. The environmental impacts analysis is discussed in Section IV. The proposed amendments will not result in any additional environmental impacts.

These proposed amendments will facilitate ARB's implementation of CaRFG and CDF regulations by:

- Specifying direct testing of denatured ethanol for future analyses of benzene, total aromatic hydrocarbons, and olefins, as opposed to indirect testing of the denaturant alone and application of a dilution factor.

- Specifying a new and more sensitive test procedure for future analyses of MTBE and other prohibited oxygenates in California gasoline.

- Deleting reference to the less sensitive ASTM D2622-94 method and specifying the more sensitive ASTM D5453-93 method for the future analyses of sulfur in California gasoline.

In addition, the proposed amendments will aid stakeholders by:

- Specifying the updated ASTM D6550-10 method for future analyses of olefins in gasoline, thereby eliminating the need for the analyst to refer to two documents to properly calculate the olefin content in California gasoline.

- Specifying the updated ASTM D4815-09 method for future analyses of permitted oxygenates in California gasoline, thereby eliminating confusion due to errors in the older version of the test method.

- Specifying the updated ASTM D5580-02 (2007) method for future analyses of benzene and aromatic hydrocarbons in California gasoline, thereby eliminating the need for the analyst to refer to two documents to properly calculate the benzene and aromatic hydrocarbon content in California gasoline.

- Specifying the updated ASTM D5186-03 (2009) method for future analyses of aromatic hydrocarbons and polycyclic aromatic hydrocarbons in California diesel fuel, thereby eliminating the requirement to run multiple QC samples each day.

The proposed amendments may result in additional voluntary costs to gasoline producers and blenders, depending on how they choose to respond to the new regulations. These costs are discussed in Section VIII.

As the proposed amendments merely change or update the test methods that are specified in CaRFG and CDF regulations, no impacts to the health, safety, and welfare of California residents, worker safety, or the state's environment and quality of life are anticipated.

H. Rationale

The proposed amendments satisfy the statutory requirement to implement motor vehicle fuel specifications for the control of air contaminants and sources of air pollution by specifying improved test methods for the determination of prohibited compounds in CaRFG, CDF, and denatured ethanol.

I. Public Process

In developing the proposed amendments, ARB staff hosted a public workshop on July 11, 2012. ARB staff used the Fuels Program e-mail list server to notify interested parties when information became available. The Fuels Program e-mail list server is a self-subscription list with over one thousand individual e-mail addresses. Staff also held several phone calls and meetings with individual stakeholders. In general, staff has been in frequent interaction with the impacted and interested stakeholders over a number of years and as these methods were being improved or developed.

Section III – Reformulated Gasoline and Diesel Fuel Test Methods

A. General Information and Proposed New Test Methods

ARB's CaRFG and CDF regulations contain specifications for various chemical and physical properties of vehicle fuels. Each specification consists of a numerical limit for and a test method by which the property is measured. The test methods are periodically updated to reflect improvements in instrumentation technology or the development of better analytical practices. The test methods for denatured ethanol, gasoline, and diesel fuel are contained in sections 2262.9, 2263(b), and 2282, Title 13, California Code of Regulations (CCR), respectively.

In most cases, the test methods specified are developed through, and published by, ASTM International, sometimes with specified modifications. ASTM International is a prominent not-for-profit organization widely recognized by industry and regulatory agencies that provides a forum for manufacturers and users of products, as well as academicians and government representatives to prepare standards based on a technical and scientific consensus approach. The two digits following the hyphen of an ASTM Test Method designation represent the year of adoption or last revision.

CaRFG3 regulations prohibit the use of all oxygenates other than ethanol and specified maximum allowable concentrations for MTBE and for the total maximum allowable oxygen content from oxygenates other than MTBE and ethanol. These allowable concentrations became lower over time. By July 2007, the maximum concentrations were below the limit of quantification (LOQ) of the specified test method, ASTM D4815-04. The proposed amendments, for future analyses, include the use of ASTM D7754-11, which has a significantly improved LOQ that will facilitate the determination of low levels of MTBE and other prohibited oxygenates.

CaRFG3 regulations also added specifications for denatured ethanol intended for blending with CARBOB. For three of the ethanol specifications (the maximum allowable concentrations of benzene, total aromatic hydrocarbons, and olefins), no adequate test method existed at the time the regulations were adopted. These compounds do not occur as a result of ethanol production; they come from the denaturant. Accordingly, CaRFG regulations call for measuring these compounds in the denaturant before the denaturant is blended with the pure ethanol and multiplying the result by a dilution factor.

ARB and stakeholders such as gasoline producers, blenders, importers, and shippers generally do not typically have access to the denaturant, which is added at the site where the ethanol is produced – typically outside of California. As a result, ARB cannot adequately enforce these denatured ethanol specifications, and other stakeholders have no way to check whether the denatured ethanol they use meets California's requirements based on the current test methodology.

To address these shortcomings, staff has worked closely with ASTM International Committee D02 on Petroleum Products and WSPA over the last nine years to develop new test methods for the regulated compounds in denatured ethanol. Staff is now proposing to incorporate into CARFG regulations, for future analyses, these

new methods, which can directly and adequately measure the amount of benzene, total aromatic hydrocarbons, and olefins in denatured ethanol. The proposed methods are listed in Tables 1 and 2.

Table 1: Proposed New Test Methods for Gasoline

Property	Existing Method	Proposed Method	Regulatory Limit	Proposed Method LOQ
MTBE content	D4815-04	D7754-11	0.05 vol%	0.005 vol%
Oxygen from other compounds	D4815-04	D7754-11	0.06 wt%	0.001 wt%

Table 2: Proposed New* Test Methods for Denatured Ethanol

Property	Existing Method*	Proposed Method	Regulatory Limit	Proposed Method LOQ
Benzene	n/a	D7576-10	0.06 vol%	0.01 vol%
Aromatic hydrocarbons	n/a	D7576-10	1.7 vol%	0.25 vol%
Olefins	n/a	D7347-07e1	0.5 vol%	0.1 vol%

*The existing method calls for measuring the properties in the denaturant, rather than in the denatured ethanol, and multiplying by a dilution factor.

The test methods proposed for analyzing benzene, aromatic hydrocarbons, and olefins in denatured ethanol would be an additional option for determining compliance with the regulatory limits. Ethanol producers and other stakeholders could still determine compliance by analyzing the pure denaturant. Staff proposes to retain the old method of testing the denaturant and multiplying by a dilution factor, because the old method is cheaper and is adequate as a screening tool. However, in the event of any discrepancy between results obtained by analyzing the denatured ethanol and analyzing the denaturant, the results obtained by analyzing the denatured ethanol using the proposed new test methods would take precedence. This is because direct analysis of these compounds in denatured ethanol does not have the additional uncertainties and errors associated with analysis of the denaturant, such as the uncertainty of the concentrations of benzene, aromatic hydrocarbons, and olefins in the pure ethanol; error in the actual dilution; and uncertainty in contamination during the blending, storage, and transportation of the denatured ethanol.

B. Technical Aspects of Proposed New Test Methods

ASTM method D7754-11 employs gas chromatography (GC) with flame ionization detection (FID), referred to as GC/FID. In gas chromatography, the mobile phase (or "moving phase") is a carrier gas, usually an inert or unreactive gas. The stationary phase is a microscopic layer of liquid or polymer on an inert solid support, inside a piece of glass or metal tubing called a column. The instrument used to

perform gas chromatography is called a gas chromatograph (GC); a schematic is provided in Figure 1. The compounds being analyzed interact with the walls of the column, which is coated with a stationary phase. This causes each compound to elute at a different time, known as the retention time of the compound. The comparison of retention times, as well as the size of the peaks displayed by the FID, allows the analyst to determine the identity and concentration of the compound.

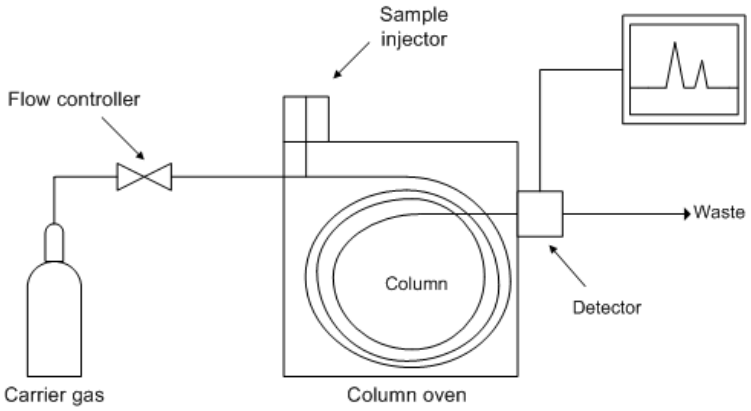

Figure 1: Schematic of a Generic GC. Source: Wikipedia, accessed Nov. 2012.

The instrument used for the currently adopted method for measuring MTBE and other prohibited oxygenates, ASTM D4815-04, can be modified with new columns to run the proposed ASTM D7754-11 method. The remainder of the GC/FID needs no further modifications.

ASTM method D7576-10 is also a GC/FID method. It uses exactly the same instrumentation as the currently adopted method for measuring benzene and total aromatic hydrocarbons in gasoline, ASTM method D5580-00.

ASTM method D7347-07e1 employs supercritical fluid chromatography with FID. The instrument used for the currently adopted method for measuring olefins in gasoline, ASTM method D6550-00, can be modified with the addition of a column to run ASTM method D7347-07e1.

C. Test Method Updates

Staff is also proposing to update several existing test methods to their most recent available versions. The proposed changes are listed in Table 3.

Table 3: Proposed Test Method Updates

Fuel Property	Existing Method	Proposed Method	Changes
Gasoline olefins	D6550-00	D6550-10	ARB-specific information
Gasoline aromatic hydrocarbons	D5580-00	D5580-02(2007)	Precision statement
Gasoline ethanol	D4815-04	D4815-09	Errors corrected
Diesel aromatic hydrocarbons	D5186-96	D5186-03(2009)	Streamlined QC

An appendix within test method ASTM D6550-10 includes ARB-specific information. When the Board adopted ASTM method D6550-00 for measuring olefins in gasoline, it included extra information concerning precision, sensitivity, and mass-volume percent correlation in the CaRFG regulation. The current version, ASTM method D6550-10, has this information included as an aid to its users. Therefore, adoption of the updated version will aid users by providing a single source of relevant information.

ASTM D5580-02(2007) has a newer precision statement than the one currently specified in the CaRFG regulations, which came from an earlier version of the method. The precision of a test method is used by ARB's Enforcement Division as the tolerance applied to ARB's and only ARB's analytical results when determining whether a fuel complies with the CaRFG and CDF regulations. Adoption of the updated version will acknowledge the precision of the test method and aid ARB's enforcement.

The new precision statement is based on an improved analysis of the same inter-laboratory study data used to generate the currently adopted precision statement. The measure of precision that is of interest to ARB is the reproducibility, which is the 95 percent confidence interval for identical samples analyzed in different laboratories. For both benzene and total aromatic hydrocarbons, the new statement provides a tighter reproducibility at some concentrations and a looser reproducibility at others. In all cases relevant to CaRFG, the difference between the old precision statement and the new one is small and is not expected to significantly impact the number of violations found by ARB. This issue has been discussed on multiple occasions with WSPA, ARB's Enforcement Division, and other stakeholders who have not raised any objections to the change. A comparison is provided in Table 4.

Table 4: ASTM D5580 Reproducibility Comparison

Property	Current Reproducibility	D5580-02(2007) Reproducibility	New Reproducibility Tighter	New Reproducibility Looser
Benzene	0.1409(X)^1.133 vol%	0.1087(X)^0.64 vol%	>0.70 vol%	<0.50 vol%
Aromatic hydrocarbons	1.40 vol%	0.2619(Y)^0.5 vol%	<28.5 vol%	>28.5 vol%

X = volume percent benzene
Y = volume percent total aromatic hydrocarbons

ASTM D4815-09 corrects minor errors in the example chromatograms and oxygenate density values that exist in the -04 version. The changes are not expected to have any effect on analytical results, but are necessary to correct the errors.

ASTM D5186-03(2009) incorporates a streamlined quality control procedure compared to the -96 version. For laboratories which analyze a variety of different diesel fuels, the new version of the method will save 30-60 minutes of overhead time every day the method is run. Therefore, staff proposes this amendment to aid stakeholders in improving their efficiency and saving costs.

Section IV – Recommended Actions

Staff recommends that the Board amend sections 2262.9, 2263(b), and 2282, Title 13, CCR, with the new test methods indicated in Tables 1 and 2 and the updated test methods in Table 3. The text of the proposed amendments is set forth in Appendix A.

A. Amend section 2262.9 to specify direct testing of denatured ethanol for future analyses

Section 2262.9 currently calls for compliance with the benzene, total aromatic hydrocarbons, and olefin specifications in denatured ethanol to be determined by measuring the denaturant before it is added to the pure ethanol; the result is then multiplied by a dilution factor to indirectly determine the concentration of the analyte in denatured ethanol. ARB and downstream stakeholders do not have access to the denaturants used in the production of denatured ethanol sold in California. As a result, neither ARB nor gasoline blenders can check the denatured ethanol for compliance with these specifications.

Now that test methods capable of adequately measuring these chemical species in denatured ethanol are available, staff recommends that section 2262.9 be amended to allow direct testing of denatured ethanol as an alternative to analyzing the denaturant. Staff recommends the designation of ASTM method D7576-10 for the measurement of benzene and total aromatic hydrocarbons in denatured ethanol, and ASTM method D7347-07e1 for the measurement of olefins in denatured ethanol. In the event of any discrepancy between results obtained by analyzing the denatured ethanol using the new test methods and analyzing the denaturant alone as has been the case in previous practice, the results obtained by analyzing the denatured ethanol would take precedence.

At this time no test methods, other than those cited above, are known to adequately perform these analyses. The only alternative to the adoption of these methods is to leave the regulations as they currently stand, which will continue to preclude adequate, downstream testing for these compounds in denatured ethanol. The proper quantification of benzene, aromatic hydrocarbons, and olefins in denatured ethanol will assure air quality protection and effective enforcement of the CaRFG regulations.

B. Amend section 2263(b) to designate ASTM D7754-11 for the future analysis of MTBE and other prohibited oxygenates in California gasoline

Section 2263(b) currently calls for measuring prohibited oxygenates in California gasoline by ASTM D4815-04. The limit of quantification of this test method is 0.2 vol% for each individual oxygenate. However, ARB's fuel regulations have phased-down the MTBE limit in four steps from a limit of 0.60 vol% starting on December 31, 2003 (0.30 vol% starting on July 1, 2004, then 0.15 vol% starting on December 31, 2005) and finally 0.05 vol% starting on July 1, 2007. Additionally, the regulations contain a limit of 0.06 wt% for the total oxygen contribution from all other prohibited oxygenates. ASTM D4815-04 cannot meet this requirement unless all of the oxygen

is coming from a single prohibited compound. As a result, neither ARB nor other stakeholders can adequately determine whether a sample of gasoline meets the current regulatory requirements.

For future analyses, staff proposes to incorporate ASTM D7754-11, which has a limit of quantification of 0.005 vol% for each individual oxygenate. This will allow ARB and other stakeholders to verify compliance with Section 2262, by more precisely measuring MTBE and oxygenates, other than ethanol, in California gasoline.

No other test methods capable of performing this analysis have been published by a recognized testing standards developer. Preliminary work on two test methods employing different technologies has been presented previously at technical meetings of the ASTM Committee D02 on Petroleum Products. While these two methods appear to be capable of measuring oxygenates at sufficiently low levels, they both require instrumentation that is significantly more expensive and difficult to operate and therefore, there has been no further development of these methods by ASTM.

As a result, the only alternatives to adopting ASTM D7754-11 as the designated test method for measuring MTBE and other prohibited oxygenates are leaving the current method, ASTM D4815-04, in the regulation, or replacing it with its latest version, ASTM D4815-09. However, the -09 version has the same limit of quantification as the -04 version, so adequate determination of compliance with the CaRFG regulations would remain problematic. ARB has a strong interest in facilitating compliance with the prohibited oxygenates element of the CaRFG regulations, because, as we discovered with MTBE, certain compounds in gasoline may result in significant groundwater contamination due to leaking underground fuel tanks.

C. Amend section 2263(b) to designate ASTM D6550-10 for the future analysis of olefins in California gasoline

An appendix within ASTM D6550-10 contains California-specific information that is absent in the currently adopted version, ASTM D6550-00. This information is currently published in footnotes to the test methods table in section 2263(b). Having the information available in the test method is more convenient for users of the method, and no cost to stakeholders will result from the change. Therefore, staff proposes the use of ASTM D6550-10 for future analyses of olefins in California gasoline.

D. Amend section 2263(b) to designate ASTM D4815-09 for the future analysis of permitted oxygenates in California gasoline

ASTM D4815-09 corrects minor errors in the -04 version. While these errors do not directly affect the method's results, they could cause confusion for analysts learning the method. The new version will avoid this possible confusion at no cost to stakeholders. Therefore, staff proposes the use of ASTM D4815-09 for future analyses of the oxygen content in California gasoline.

E. Amend section 2263(b) to designate ASTM D5580-02(2007) for the future analysis of benzene and total aromatic hydrocarbons in California gasoline

ASTM D5580-02(2007) contains a different, and more appropriate, precision statement than what is present in the footnotes to the test methods table in section 2263(b). For any given gasoline sample, the precision calculated using -07 version may be tighter or looser than the precision calculated using the equations in section 2263(b). However, the differences are small, and for all of California gasoline blends as a whole, no significant difference in precision (and therefore enforceability) is expected. This issue has been discussed on multiple occasions with WSPA, ARB's Enforcement Division, and other stakeholders who have not raised any objections to the change. Having the precision statements available in the published test method is more convenient for users than having a separate statement as a footnote in the regulations, and no cost to stakeholders will result from the change. Therefore, staff proposes the use of ASTM D5580-02(2007) for future analyses of benzene and total aromatic hydrocarbons in California gasoline.

F. Amend Section 2263(b) to remove ASTM D2622-94 for the future analysis of sulfur in California gasoline

Section 2263(b) currently specifies both ASTM D2622-94 and ASTM D5453-93 for the measurement of sulfur in California gasoline. However, ASTM D2622-94 has a limit of quantification of 10 ppm sulfur, which is higher than the levels currently observed in most California gasoline blends. On the other hand, ASTM D5453-93 is more sensitive, and therefore, more appropriate for lower levels of sulfur in gasoline. Recent discussions with WSPA indicated that no California refiner is using ASTM D2622-94 in the production of fuel for use in California. Therefore, no costs to stakeholders are expected from this change. Therefore, staff proposes the removal of ASTM D2622-94 for future analyses of sulfur in California gasoline.

G. Amend section 2282 to designate ASTM D5186-03(2009) for the future analysis of aromatic hydrocarbons and polycyclic aromatic hydrocarbons in California diesel fuel

The QC section of ASTM D5186-96 requires that laboratories which analyze a wide variety of diesel fuels run several different QC samples each day. Studies conducted by ASTM Committee D02 determined that this requirement is excessive, so ASTM D5186-03(2009) requires only a single QC sample each day. ARB staff is in agreement with the change. There are no other significant changes to the test method in the 2009 version. Adoption of the new version will save time and money for laboratories which are able to reduce their QC analyses, and will have no cost for other stakeholders. Therefore, staff proposes the use of ASTM D5186-03(2009) for future analyses of aromatic hydrocarbons and polycyclic aromatic hydrocarbons in California diesel fuel.

Section V – Alternatives to the Proposed Amendments

ARB staff considered potential alternatives to each of the proposed amendments. They are discussed in more detail below.

A. Analysis of Denatured Ethanol in California Gasoline

ARB staff considered the no action alternative to the proposed amendment for analysis of denatured ethanol in California gasoline. The proposed amendment provides for the direct analysis of benzene, total aromatic hydrocarbons, and olefins in denatured ethanol. The current CaRFG regulations specify indirect measurement of these compounds in the denaturant prior to its addition to the pure ethanol, followed by application of a dilution factor. ARB staff has concluded that the proposed amendments are more appropriate than the no action alternative because:

- ARB and downstream stakeholders do not have access to the denaturants used in the production of denatured ethanol sold in California, because the denaturant is typically added to ethanol outside of California.

- ARB and gasoline blenders can't directly check the denatured ethanol for compliance with these specifications.

- Direct analysis of benzene, aromatic hydrocarbons, and olefins in denatured ethanol does not have the additional uncertainties and errors associated with analysis of the denaturant, such as the uncertainty of the concentrations of these compounds in the pure ethanol; error in the actual dilution; and uncertainty in contamination during the blending, storage, and transportation of the denatured ethanol.

B. Analysis of MTBE and other Prohibited Oxygenates in California Gasoline

ARB staff considered two alternatives to the proposed amendment: the no action alternative and updating the current test method with its latest version, ASTM D4815-09. ARB staff has concluded that the proposed amendments are more appropriate than the no action alternative, because the current test method does not have a sufficiently low limit of quantification to adequately measure down to the regulatory limit. ARB staff also concluded that amending the regulations to the updated version, ASTM D4815-09, is also not appropriate, because the updated version has the same limit of quantification as the current version of ASTM D4815. Therefore, the proposed amendments are more appropriate than the alternatives, because the amendments will allow ARB and other stakeholders to verify compliance with Section 2262, by more precisely measuring MTBE and oxygenates, other than ethanol, in California gasoline.

C. California-Specific Information for Testing Olefins in California Gasoline

ARB staff considered the no action alternative to the proposed amendment for the California-specific information for testing olefins in California gasoline. ARB staff has concluded that the proposed amendments are more appropriate than the no action

alternative because the proposed amendments adopt the updated test method, which consolidates the California-specific information into the test method. Therefore, the proposed amendments eliminate the need to rely on two documents to properly calculate the olefin content, thereby minimizing the inconvenience and confusion to the analyst.

D. Analysis of Permitted Oxygenates in California Gasoline

ARB staff considered the no action alternative to the proposed amendment for the analysis of permitted oxygenates in California gasoline. However, the proposed amendments are more appropriate than the no action alternative, which would retain the existing ASTM D4815-04 and which includes minor errors that could cause confusion for analysts learning the method.

E. Analysis of Benzene and Aromatic Hydrocarbons in California Gasoline

ARB staff considered the no action alternative to the proposed amendment for the analysis of benzene and aromatic hydrocarbons in California gasoline. However, the proposed amendments are more appropriate than the no action alternative, because the formulas to determine reproducibility of benzene and total aromatic hydrocarbons that are given in the footnotes to the regulation are no longer appropriate. The correct formulas are given in the updated test method, ASTM D5580-02(2007). Therefore the proposed amendments eliminate the need to rely on two documents to properly calculate the benzene and aromatic hydrocarbon content, thereby minimizing the inconvenience and confusion to the analyst.

F. Analysis of Sulfur in California Gasoline

ARB staff considered the no action alternative to the proposed amendment for the analysis of sulfur in California gasoline. ARB staff has concluded that the proposed amendments are more appropriate than the no action alternative, because one of the current test methods, ASTM D2622-94, does not have a sufficiently low limit of quantification to adequately measure sulfur at levels currently observed in most California gasoline blends.

G. Analysis of Aromatic Hydrocarbons and Polycyclic Aromatic Hydrocarbons in California Diesel Fuel

ARB staff considered the no action alternative to the proposed amendment for the analysis of aromatic hydrocarbons and polycyclic aromatic hydrocarbons in California diesel fuel. ARB staff has concluded that the proposed amendments are more appropriate than the no action alternative, because the proposed amendments allow the analyst to run only one QC sample each day, as opposed to multiple and unnecessary QC samples each day, thereby saving time and materials for the analyst.

H. Reasonable Alternatives that would Lessen the Impact on Small Business

ARB staff has also considered the potential alternatives to the proposed amendments that would lessen any adverse impact on small business (namely, those alternatives discussed above). However, as discussed above, the proposed amendments are more appropriate than the no action alternative for the reasons provided above. In addition, because analytical testing of the CaRFG or CDF is not required by the regulations, no small business is obligated to conduct fuel testing.

Section VI – Environmental Impact Analysis

A. Introduction

This chapter provides an environmental analysis for the proposed regulation. Staff has determined that implementation of the proposed new and updated test methods for the analysis of CaRFG3, denatured ethanol, and diesel fuel would not result in any potentially significant adverse impacts on the environment. This analysis provides the basis for reaching this conclusion.

B. Environmental Review Process (CEQA)

ARB is the lead agency for the proposed regulation and has prepared this environmental analysis pursuant to its regulatory program certified by the Secretary of the Natural Resources Agency (14 CCR 15251(d); 17 CCR 60005-60007). In accordance with Public Resources Code section 21080.5 of the California Environmental Quality Act (CEQA), public agencies with certified regulatory programs are exempt from the requirements for preparing environmental impact reports, negative declarations, and initial studies (14 CCR 15250). As required by ARB's certified regulatory program, and the policy and substantive requirements of CEQA, ARB has prepared, as part of this staff report, an assessment of the potential for significant adverse and beneficial environmental impacts associated with the proposed regulation and a succinct analysis of those impacts (17 CCR 60005(b)). The resource areas from the CEQA Guidelines Environmental Checklist were used as a framework for assessing the potential for significant impacts (17 CCR 60005(b)).

If comments received during the public review period raise significant environmental issues, staff will summarize and respond to the comments in writing. The written responses will be included in the Final Statement of Reasons for the regulation. Prior to taking final action on any proposed action for which significant environmental issues have been raised, the decision maker shall approve the written responses to these issues (17 CCR 60007(a)). If the regulation is adopted, a Notice of Decision will be posted on ARB's website and filed with the Secretary of the Natural Resources Agency for public inspection (17 CCR 60007(b)).

C. Proposed Regulations

1. Description

   The proposed amendments are described in detail in Section III of this Staff Report. Briefly, the proposed amendments include the following changes:

   - Replace one gasoline test method which isn't sufficiently sensitive with a new one;
   - Add two test methods for determining whether denatured ethanol complies with existing regulations;
   - Update four existing test methods to current versions; and

- Remove one obsolete test method for future analyses.

2. Methods of Compliance

The use of ARB's proposed fuel test method amendments is voluntary, because the CaRFG and CDF regulations do not require stakeholders to test their fuels. The proposed fuel test method amendments are previously discussed in detail in Section III**.** If the regulated community opts to test their California gasoline using ARB's proposed, specified methods, they may need to upgrade existing, or purchase new, fuel test equipment as described previously in Section III in order to comply with the new gasoline test methods. No equipment upgrades would be required for the methods being updated to current versions.

The use of the new methods to analyze denatured ethanol would be entirely optional, because the CaRFG regulations do not require stakeholders to test the denatured ethanol or denaturant; the regulated community could continue to use existing procedures for determining compliance with the denatured ethanol specifications. However, in the event of any discrepancy between results obtained by analyzing the denatured ethanol and analyzing the denaturant, the results obtained by analyzing the denatured ethanol would take precedence.

D. Environmental Impacts

1. Beneficial Impacts

The proposed test procedures are designed to ensure that fuels sold within California meet specified standards. There are no emissions reductions associated with the proposed amendments, because the proposed amendments merely change the test procedures; they do not change the specifications of the fuels.

2. Resource Areas with No Impacts

Based on ARB's review of the proposed regulatory amendments, staff concludes that the amendments would not have a significant adverse effect on the environment. Compliance with the proposed amendments would not result in any physical change to the existing environment because the amendments affect only the test methods used to determine whether fuels comply with the applicable regulations. Thus, the amendments would not involve or result in any physical changes to the existing environment, such as new development, modifications to existing buildings or facilities, or new land use designations. Further, since compliance with the proposed amendments would be related only to test methods that are voluntary, the amendments would not involve any activity that would entail or affect aesthetics, air quality, agricultural and forestry resources, biological resources, cultural resources, geology and soils, greenhouse gases, hazardous material, hydrology and water quality, land use planning, mineral resources, noise, population and

housing, public services, recreation, or traffic and transportation. The proposed amendments would not require any action by regulated parties that could affect these resources.

Impact on the State Implementation Plan (SIP)

ARB's 2007 SIP proposal is a comprehensive strategy designed to attain federal air quality standards as quickly as possible through a combination of technologically feasible, cost-effective, and far reaching measures. The total magnitude of the reductions to be achieved through new actions is primarily driven by the scope of the air quality problems in the San Joaquin Valley and South Coast Air Basin. These proposed amendments would not have any impact on the SIP, because the proposed amendments merely change the test procedures for fuel analysis.

No discussion of alternatives or mitigation measures to address significant adverse environmental impacts is necessary because no significant adverse environmental impacts would result from implementation of the proposed amendments. This is because the proposed amendments merely change the test procedures for fuel analysis, without changing any gasoline or diesel ingredient.

Section VII – Environmental Justice

ARB is committed to evaluating community impacts of proposed regulations, including environmental justice concerns. Because some communities experience higher exposures to air pollutants, it is a priority of ARB to ensure that full protection is afforded to all Californians. The proposed amendments are not expected to have an effect on community health, because they merely change the test procedures for fuel analysis.

Section VIII - Economic and Fiscal Impacts

In this section, staff provides estimates of the costs to businesses who voluntarily choose to follow the proposed amendments. The amendments could directly apply to approximately 100 businesses in the state. The affected businesses include refineries producing gasoline and diesel fuel for sale in California, distribution terminals, ethanol producers, and producers and importers of denatured ethanol for gasoline blending.

A. Effects of the Proposed Amendments

1. Cost of allowing direct testing of denatured ethanol

   Staff's proposal provides the option of directly testing denatured ethanol for olefin, benzene, and total aromatic hydrocarbon content as an alternative to testing of the denaturant before it is blended into ethanol. (Note, however, as previously discussed in the event of any discrepancy between results obtained by analyzing the denatured ethanol and analyzing the denaturant, the results obtained by analyzing the denatured ethanol would take precedence.) Discussions with major terminal operators in California indicated that they currently rely on certifications provided by the producers of the denatured ethanol they use and will likely continue to do so, rather than implementing the new optional test methods. An interview with a representative of the ethanol industry indicated that ethanol producers do not intend to change their current procedures for complying with the specification involved. From these discussions, staff does not anticipate any economic impact on the affected industries. If all terminals and ethanol producers were to voluntarily purchase instrumentation to run the new test methods, in contrast to Staff's expectations, the cost would be approximately $120,000 per facility.

2. Cost of designating ASTM D7754-11 for the analysis of MTBE and other prohibited oxygenates in California gasoline

   Staff's proposal would change the designated test method for measuring MTBE and other prohibited oxygenates in gasoline from ASTM D4815-04 to ASTM D7754-11. While the use of the designated test method is not required by regulation, discussions with WSPA indicated that refinery operators in California are very likely to use the new method. Discussions with terminal operators in California indicated that they do not currently use ASTM D4815-04 and are not planning to use ASTM D7754-11.

   The discussions with WSPA suggest that each refinery will likely use a single instrument to run ASTM D7754-11, which could be purchased new or obtained by upgrading an existing ASTM D4815-04 instrument. Upgrading an existing ASTM D4815-04 instrument to run ASTM D7754-11 would simply involve a change in the column, with no further modifications required of the remainder of the GC/FID. Purchasing a new instrument to run ASTM D7754-11 would be more expensive than upgrading an existing instrument. For

purposes of this economic analysis, staff assumes that each refinery will purchase a new instrument.

Pricing data obtained by staff from the manufacturer of the ASTM D7754-11 equipment indicate that a new instrument will cost approximately $60,000. Operation and maintenance costs are typically estimated at 10 percent of an instrument's cost ($6,000 in this case) per year. Over a five year period, the present cash value of the operation and maintenance costs would be $26,000.

The new instruments are expected to cost the refining industry approximately $1.2 million over a five year period (14 refineries X ($60,000 initial cost + $26,000 for five years' maintenance.)) Approximately 13 billion gallons of CARFG are produced annually by California refiners, making the cost of the new instruments 0.002 cents per gallon over five years. This cost increase is not expected to have a significant impact on the profitability of California refiners. As a result, staff expects no significant change in employment, business competitiveness, or the status of businesses in California due to the change of test methods.

From information obtained during interviews, staff does not expect terminal operators to purchase instrumentation for running ASTM D7754-11. Terminals do not currently test for trace prohibited oxygenates, and are not expected to begin doing so. In the most conservative scenario, if all terminal operators were to change their plans and decide to test per the staff's proposal, the additional cost to the industry to purchase the instrumentation to run ASTM D7754-11 would be approximately $6.5 million (75 terminals x ($60,000 + $26,000)) over five years, for a total cost of $7.7 million. The cost of the new instruments for all facilities would translate to 0.012 cents per gallon over five years.

3. Cost of Updating ASTM D4815, D5580, and D6550 to Newer Versions and Removing ASTM D2622-94 for future analyses

   Staff's proposal to update existing test methods to newer versions for oxygen, benzene, aromatic hydrocarbons, and olefin content and to remove the obsolete method ASTM D2622-94 for future analyses of sulfur is not expected to have any significant impact on the operations of any business in California. As a result, staff expects no economic impact on the affected industries.

B. Costs to Produce CARFG and CDF

No impacts to the cost to produce CaRFG or CDF are expected, because the proposed amendments merely change the test methods for conducting fuel analysis; they do not change the specifications of CaRFG or CDF or add or remove any ingredient from gasoline or diesel fuel.

C. Creation or Elimination of Jobs within the State

No impacts to the creation or elimination of jobs within the state are anticipated because the proposed amendments merely change the test procedures for conducting fuel analysis; they do not change the specifications for CaRFG or CDF and are not expected to increase the production costs. A few jobs could be created at terminals if these facilities were to decide to run the new test methods. However, interviews with terminal operators have suggested that this is unlikely.

D. Creation of New Businesses or the Elimination of Existing Businesses within the State

No impacts to the creation of new business or elimination of existing businesses within the state are anticipated because the proposed amendments merely change the fuel test procedures; they do not change the specifications for CaRFG or CDF and are not expected to increase the production costs.

E. Competitive Advantages or Disadvantages for Businesses Currently Doing Business within the State

No impacts to the competitive advantages or disadvantages for businesses currently doing business within the state are anticipated because the proposed amendments merely change the fuel test procedures; they do not change the specifications for CaRFG or CDF and are not expected to increase the production costs.

F. Increase or Decrease of Investment in the State

No impacts to the increase or decrease of investment in the state are anticipated because the proposed amendments merely change the fuel test procedures; they do not change the specifications for CaRFG or CDF and are not expected to increase the production costs.

G. Incentives for Innovation in Products, Materials, or Processes

As the proposed amendments change the specifications for CaRFG or CDF by implementing more precise and sensitive test methods, minimal incentives to innovation in products, materials, or processes may be experienced.

H. Impact on Government Revenue

No impact on government revenue is expected as a result of the amendments because gasoline and diesel fuel sales and costs will remain unimpacted by the staff's proposal.

I. Impact on Small Refiners

No additional costs to produce CaRFG or CDF are expected as a result of the amendments for small refiners, because no changes in fuel formulations or production are expected.

J. Small Business Economic Effect

Government Code sections 11342 et. seq. require ARB to consider any adverse effects on small businesses that would have to comply with a proposed regulation. In defining small business, Government Code section 11342 explicitly excludes refiners from the definition of "small business." Also, the definition includes only businesses that are independently owned and, if in retail trade, gross less than $2,000,000 per year. Thus, our analysis of the economic effects on small business is limited to the costs to gasoline and diesel retailers and jobbers, retailers, and gasoline and diesel fuel end-users. A jobber is an individual or business that purchases wholesale gasoline and delivers and sells it for profit to another party, usually a retailer or other end-user.

1. Jobbers and Retailers

   No economic impact is expected to affect jobbers and retailers as a result of the amendments because they do not certify fuel formulations for sale. Furthermore, these amendments would not change production costs or volumes, so fuel prices and supplies should remain unchanged.

2. Gasoline and Diesel Fuel End-Users

   No economic impact is expected to affect jobbers and retailers as a result of the amendments because fuel prices and supplies should remain unchanged.

K. Fiscal Impacts

1. Impact on Government Revenue

   No impact on government revenue is expected as a result of the amendments because gasoline and diesel fuel sales and costs will remain unchanged.

2. Impact on Government Expenditures

   No impact on government entities as fuel end-users is expected as a result of the amendments because gasoline and diesel fuel sales and costs will remain unchanged.

   There will be no additional person-years needed to enforce the amendments because the amendments do not add additional enforcement requirements above what is already currently being enforced.

L. Reasonable Alternatives to the Amendments

ARB staff considered potential alternatives to the proposed amendments (namely, the no action alternative in most cases and updates to existing test methods). ARB staff determined the proposed amendments are more appropriate than the alternatives considered. The proposed amendments include improved test methods

that provide better sensitivity and reduce the number of QC samples necessary to conduct fuel analysis.

No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to affected private persons than the proposed regulation.

M. Description of Reasonable Alternatives Considered that would Lessen Impact on Small Business

ARB staff has also considered the potential alternatives to the proposed amendments that would lessen any adverse impact on small business. However, as discussed above, the proposed amendments are more appropriate than the alternatives considered.

N. Evidence relied upon to support initial determination in the notice that the regulation will not have a significant adverse economic impact on business

While CaRFG and CDF regulations do not require refiners or terminal operators to test their fuel, discussions with WSPA have indicated that each gasoline refinery in California is likely to purchase one instrument for running ASTM D7754-11.

Staff contacted the manufacturer of the ASTM D7754-11 equipment, who indicated that a new instrument will cost approximately $60,000. Assuming operation and maintenance costs of 10% of an instrument's cost each year, staff assumes the present cash value of the operation and maintenance costs would be $26,000. The new instruments are expected to cost the refining industry approximately $1.2 million over a five year period (14 refineries X ($60,000 initial cost + $26,000 for five years' maintenance.)) Approximately 13 billion gallons of CaRFG are produced annually by California refiners, making the cost of the new instruments 0.002 cents per gallon over five years.

From information obtained during interviews, staff does not expect terminal operators to purchase instrumentation for running ASTM D7754-11. Terminals do not currently test for trace prohibited oxygenates, and are not expected to begin doing so. As a worst-case scenario, if all terminal operators were to purchase the instrumentation to run ASTM D7754-11, the additional cost to the industry would be approximately $6.5 million (75 terminals x ($60,000 + $26,000)) over five years, for a total cost of $7.7 million. The cost of the new instruments for all facilities would be 0.012 cents per gallon over five years.

O. Justification for adoption of regulations different from federal regulations contained in the Code of Federal Regulations

The Federal Reformulated Gasoline (RFG) regulations apply to about 80 percent of California's gasoline and are set forth in Code of Federal Regulations (CFR), title 40, part 80, section 40 et seq. CaRFG regulations apply to all gasoline sold, supplied, or offered in California. All CaRFG meets or exceeds the requirements of the federal RFG regulations, resulting in significant additional emission reductions and

corresponding improvements in air quality. Under 40 CFR § 80.81, gasoline meeting the CaRFG3 standards is exempt from several of the enforcement requirements of the federal RFG regulations. Differing state regulations are not only authorized by law, but any cost of the differing state regulations is justified by the benefit to human health, public safety, public welfare, or the environment. However, as these proposed amendments merely change the fuel test procedures, no additional impact to human health, public safety, public welfare, or the environment is anticipated. The amendments are necessary to implement the most precise and efficient test methods to determine compliance with the CARFG and CDR regulations.

P. Benefits of the regulation to the health and welfare of California residents, worker safety, and the state's environment

The proposed test procedures are designed to ensure that fuels sold within California meet specified standards. However the test procedures themselves do not generate additional emissions reductions.

Indirect, beneficial environmental impacts may result by amending section 2282 to designate ASTM D5186-03(2009) for the analysis of aromatic hydrocarbons and polycyclic aromatic hydrocarbons in diesel fuel. This is because the current method, ASTM D5186-96, which requires laboratories that analyze a wide variety of diesel fuels, requires the laboratories run several different QC samples each day. The proposed amendment to use ASTM D5186-03(2009) requires only a single QC sample each day. Therefore, use of the newer test method will reduce environmental impacts associated with the production, transportation, use, and disposal of materials used to run the additional QC samples.

As the proposed amendments merely change or update the test methods that are specified in CaRFG and CDF regulations, no direct impacts to the health, safety, and welfare of California residents, worker safety, or the state's environment and quality of life are anticipated.

Section IX – Summary and Rationale for Proposed Regulations and Staff Recommendation

The proposed amendments would provide the option of direct testing of chemical properties of denatured ethanol, and would change or update certain test methods used in the analysis of California gasoline and diesel fuel.

A. Section 2262.9(b) – Denatured Ethanol Test Methods

Summary of Proposed Amendment

This amendment adds an option for directly measuring the concentrations of benzene, total aromatic hydrocarbons, and olefins in denatured ethanol.

Rationale for Proposed Amendment

CaRFG regulations currently call for determining these chemical properties of denatured ethanol by measuring them in the denaturant before it is blended into the ethanol, and then multiplying the result by a dilution factor. ARB and many downstream California gasoline blenders do not have access to the denaturant, since it is blended into the ethanol before the resulting denatured ethanol is shipped to California. As a result, determining whether a sample of denatured ethanol complies with the regulations is problematic for ARB and the downstream California gasoline blenders.

The proposed amendment adds an option to use newly developed test methods, for future analyses, to measure these chemical properties directly, enabling downstream enforcement of ARB's regulations. In the event of any discrepancy between results obtained by analyzing the denatured ethanol and analyzing the denaturant, the results obtained by analyzing the denatured ethanol would take precedence. This is because direct analysis of benzene, aromatic hydrocarbons, and olefins in denatured ethanol does not have the additional uncertainties and errors associated with analysis of the denaturant, such as the uncertainty of the concentrations of these compounds in the pure ethanol; error in the actual dilution; and uncertainty in contamination during the blending, storage, and transportation of the denatured ethanol. Clarification is included in the regulations to ensure that if a regulated party determines the denatured ethanol is compliant based on analysis of the denaturant and ARB determines it is non-compliant based on analysis of the denatured ethanol, ARB may take enforcement action.

B. Section 2263(b) – Gasoline Test Methods

Summary of Proposed Amendment

This amendment changes the test method for MTBE and other prohibited oxygenates to ASTM D7754-11. It also updates methods ASTM D4815-04, D5580-00, and D6550-00 to their most recent published versions, and removes ASTM D2622-94 for future analyses.

Rationale for Proposed Amendment

The fuel regulations currently specify ASTM method D4815-04 for measuring MTBE and other prohibited oxygenates. ARB's fuels regulations have phased-down the MTBE limit in four steps from a limit of 0.60 vol% starting on December 31, 2003 (0.30 vol% starting on July 1, 2004, then 0.15 vol% starting on December 31, 2005) and finally 0.05 vol% starting on July 1, 2007. Additionally, the maximum oxygen content from other prohibited oxygenates is 0.06 wt%. However, ASTM D4815-04 is not sensitive enough to adequately measure these concentrations. ASTM D7754-11 is sufficiently sensitive and will enable enforcement of the regulation of prohibited oxygenates. Therefore, staff proposes the use of ASTM D7754-11 for all future analyses for MTBE and other prohibited oxygenates.

ASTM D4815-04, D5580-00, and D6550-00 are the test methods designated for measuring ethanol, aromatic hydrocarbons, and olefins in gasoline, respectively. Newer versions of these methods are available. These newer versions correct errors, provide improved precision statements, and offer additional information of use to users of the methods. Therefore, staff proposes the use of these newer versions of the test methods for all future analyses.

Method ASTM D2622-94 is one of two test methods designated for measuring sulfur in gasoline. It is not sufficiently sensitive for the analysis of California gasoline blends. Elimination of this method for future analyses will prevent potential confusion concerning its applicability.

C. Section 2282 – Diesel Fuel Test Methods

Summary of Proposed Amendment

This amendment updates ASTM D5186-96, the test method designated for measuring total aromatic hydrocarbons and polycyclic aromatic hydrocarbons in diesel fuel to its most recently published version.

Rationale for Proposed Amendment

The most recently published version of the diesel aromatic hydrocarbons test method, ASTM D5186-03(2009), contains streamlined QC procedures. The new procedures allow laboratories that analyze a wide variety of diesel fuels to run a single quality control sample, rather than the several samples called for in the -96 version. Recent evidence suggests that multiple QC samples are unnecessary. This change, applicable to future analyses, will allow laboratories to save up to an hour each day in which samples are analyzed without jeopardizing the quality of the test results.

D. Staff Recommendation

For the reasons stated above, staff recommends the Board adopt the amendments to the gasoline and diesel fuel test methods, as described in this staff report.

Section X – Documents Incorporated by Reference

ASTM (2009), Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C_1 to C_4 Alcohols in Gasoline by Gas Chromatography, in *Annual Book of ASTM Standards*, Method D4815-09, ASTM International, West Conshohocken, Pennsylvania, 2009.

ASTM (2009), Standard Test Method for Determination of Aromatic Content and Polynuclear Aromatic Content of Diesel Fuels and Aviation Turbine Fuels by Supercritical Fluid Chromatography, in *Annual Book of ASTM Standards*, method D5186-03(2009), ASTM International, West Conshohocken, Pennsylvania, 2003, reapproved without change, 2009.

ASTM (2007), Standard Test Method for Determination of Benzene, Toluene, Ethylbenzene, p/m Xylene, o Xylene, C9 and Heavier Aromatics, and Total Aromatics in Finished Gasoline by Gas Chromatography, in *Annual Book of ASTM Standards,* method D5580-02(2007) , ASTM International, West Conshohocken, Pennsylvania, 2002, reapproved without change, 2007.

ASTM (2010), Standard Test Method for Determination of Olefin Content of Gasolines by Supercritical Fluid Chromatography, in *Annual Book of ASTM Standards*, method D6550-10, ASTM International, West Conshohocken, Pennsylvania, 2010.

ASTM (2007), Standard Test Method for Determination of Olefin Content in Denatured Ethanol by Supercritical Fluid Chromatography, in *Annual Book of ASTM Standards*, method D7347-07e1, ASTM International, West Conshohocken, Pennsylvania, 2007.

ASTM (2010), Standard Test Method for Determination of Benzene and Total Aromatics in Denatured Fuel Ethanol by Gas Chromatography, in *Annual Book of ASTM Standards*, method D7576-10, ASTM International, West Conshohocken, Pennsylvania, 2010.

ASTM (2011), Standard Test Method for Determination of Trace Oxygenates in Automotive Spark Ignition Engine Fuel by Multidimensional Gas Chromatography, in *Annual Book of ASTM Standards*, method D7754-11, ASTM International, West Conshohocken, Pennsylvania, 2011.

Appendix A

Proposed 2013 Amendments to the Regulations for Gasoline and Diesel Fuel Test Methods

PROPOSED REGULATION ORDER

PROPOSED 2012 AMENDMENTS TO THE REGULATIONS FOR GASOLINE AND DIESEL FUEL TEST METHODS

Note: The proposed amendments are shown in underline to indicate additions and ~~strikeout~~ to Indicate deletions, compared to the preexisting regulatory language. The symbol "* * * * *" means that intervening text not being amended is not shown. Subsection headings are shown in ***bold italics*** and are to be italicized in Barclays California Code of Regulations.

Amend Sections 2262.9, 2263, and 2282, Title 13, California Code of Regulations (CCR) to read:

California Code of Regulations, Title 13, Division 3
Chapter 5. Standards for Motor Vehicle Fuels
Article 1. Standards for Gasoline
Subarticle 2. Standards for Gasoline Sold Beginning March 1, 1996

§ 2262.9. Requirements Regarding Denatured Ethanol Intended For Use as a Blend Component in California Gasoline.

*** * * * ***

(b) Test Methods

(1) In determining compliance with the denatured ethanol standards in section (a)(1)(A):

*** * * * ***

(C) Starting [**insert effective date**], the aromatic hydrocarbon and benzene content of denatured ethanol shall be determined by ASTM D7576-10, which is incorporated herein by reference. Starting [**insert effective date**], the olefin content of denatured ethanol shall be determined by ASTM D7347-07e1, which is incorporated herein by reference.

(D) In the event of any discrepancy between results obtained by using sections 2262.9 (b)(1)(B) and 2262.9 (b)(1)(C), the results obtained by using section 2262.9 (b)(1)(C) shall take precedence.

* * * * *

Note: Authority cited: Sections 39600, 39601, 43013, 43013.1, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018, 43101 and 43830.8, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

§ 2263. Sampling Procedures and Test Methods.

* * * * *

(b) ***Test Methods.***

(1) In determining compliance with the gasoline standards set forth in this subarticle 2, including those in the sections identified in Table 1, the test methods presented in Table 1 shall be used. All identified test methods are incorporated herein by reference.

Table 1

Section	*Gasoline Specification*	*Test Method* [a]
* * * * *		
2262	Sulfur Content	ASTM D 2622-94 [c, d] or ASTM D 5453-93 (Through [**insert day before effective date**]) ASTM D 5453-93 (Starting [**insert effective date**])
2262	Benzene Content	ASTM D 5580-00 [e] (Through [**insert day before effective date**]) ASTM D 5580-02 (2007) (Starting [**insert effective date**])
2262	Olefin Content	ASTM D 1319-95a [f] (Through December 31, 2001) ASTM D 6550-00[g,h,i] (Starting January 1, 2002 through [**insert day before effective date**]) ASTM D 6550-10[k,l,m] (Starting [**insert effective date**])
2262	Oxygen Content	ASTM D 4815-04 (Through [**insert day before effective date**]) ASTM D 4815-09 (Starting [**insert effective date**])
* * * * *		
2262	Aromatic Hydrocarbon Content	ASTM D 5580-00[j] (Through [**insert day before effective date**])

		ASTM D 5580-02 (2007) (Starting [**insert effective date**])
2262.5(b)	Ethanol Content	ASTM D 4815-04 (Through [**insert day before effective date**]) ASTM D 4815-09 (Starting [**insert effective date**])
2262.6	MTBE Content	ASTM D 4815-04 (Through [**insert day before effective date**]) ASTM D 7754-11 (Starting [**insert effective date**])
2262.6(c)	Oxygen from oxygenates identified in section 2262.6(c)(4)	ASTM D 4815-04 (Through [**insert day before effective date**]) ASTM D 7754-11 (Starting [**insert effective date**])

[a] Do not report values below the limit of detection (LOD) specified in the test method. Where a test method does not specify a LOD, do not report values below the lower limit of the scope of the test method.

[b] Delete paragraph 4(b) concerning sampling.

[c] Make the following modifications to paragraph 9.1:

Low Level Sulfur Calibration Procedure

Reagents Thiophene, at least 99% purity 2-Methylthiophene, at least 98% purity Toluene, reagent grade 2,2,4-Trimethylpentane, reagent grade

Preparation of Stock Standard Weigh standard materials thiophene (~ 0.7290 gm) and 2-methylthiophene (~ 0.7031 gm) separately into a tared volumetric flask and record the individual mass to 0.1 mg. Add "mixed solvent" containing 25% toluene and 75% iso-octane (by volume) into the flask to a net weight of approximately 50 gm and record the weight. This "Stock Standard" contains approximately 10 mg/gm sulfur. The actual sulfur concentration can be calculated as follows:

Sulfur from thiophene (gm) = Weight of thiophene *32.06* purity/84.14

Sulfur from 2-methylthiophene (gm) = Weight of 2-methylthiophene *32.06* purity/98.17

Sulfur concentration of Stock Standard (gm/gm) = (sulfur from thiophene + sulfur from 2-methylthiophene)/net weight of the stock standard

Multiply the sulfur concentration by 1000 to convert the unit to mg/gm.

Preparation of Calibration Standards Pipet 2.5 ml of the Stock Standard to 250 ml flask and dilute with the "mixed solvent" to the mark. The "Diluted Standard" contains approximately 100 mg/kg sulfur. Prepare 5, 10, 20, 30, 50, 75 ppm calibration standards by pipetting 5, 10, 20, 30, 50, 75 ml of the Diluted Standard into a 100 ml flask, respectively, and diluting with the "mixed solvent" to the mark. The actual concentration of the calibration standard should be determined from the stock standard. The standards with concentration ranging from 5 to 100 ppm and the "mixed solvent" are to be used for calibrating the instrument.

[d] Replace ASTM D 2622-94 reproducibility values with the following:

Sulfur Content, ppm	*Reproducibility*
10 to 30	40.5% x Sulfur Content (ppm)
>30	19.2% x Sulfur Content (ppm)

[e] The reproducibility of benzene is as follows:

Reproducibility = 0.1409 ($X^{1.133}$), where X = vol %

[f] Add the following reproducibility statement for oxygenate-containing samples:

	Range	*Reproducibility*
Olefins	0.3 - 33	$0.819(X)^{0.6}$

X = Volume %

[g] Replace ASTM D6550-00 reproducibility equation with the following:

Reproducibility = $0.32\ X^{0.5}$

where X is between 0.3 and 25 mass % olefin

[h] The conversion from mass % olefin to volume % olefin is defined as follows:

volume % olefin = 0.857 * mass % olefin

[i] Replace the last sentence in ASTM D6550-00 section 1.1 with the following:

The application range is from 0.3 to 25 mass % total olefins.

[j] The reproducibility of total aromatic hydrocarbon is as follows:

Reproducibility = 1.4 volume%

[k] Replace ASTM D6550-10 reproducibility equation with the following:

Reproducibility = $0.32\ X^{0.5}$

where X is between 0.3 and 25 mass % olefin

[l] The conversion from mass % olefin to volume % olefin is defined as follows:

volume % olefin = 0.857 * mass % olefin

[m] Replace the last sentence in ASTM D6550-10 section 1.1 with the following:

The application range is from 0.3 to 25 mass % total olefins.

* * * * *

Note: Authority cited: Sections 39600, 39601, 43013, 43013.1, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43013.1, 43016, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal.3d 411, 121 Cal. Rptr. 249 (1975).

California Code of Regulations, Title 13, Division 3
Chapter 5. Standards for Motor Vehicle Fuels
Article 2. Standards for Diesel Fuel

§ 2282. Aromatic Hydrocarbon Content of Diesel Fuel.

* * * * *

(c) ***Test Method.*** Compliance with the aromatic hydrocarbon content limitations specified in this section 2282 shall be determined by ASTM Test Method D 5186-96, which is incorporated herein by reference, through [**insert day before effective date**]. Starting [**insert effective date**], compliance shall be determined by ASTM D5186-03(2009), which is incorporated herein by reference. The following correlation equation shall be used to convert the SFC results in mass percent to volume percent.:

* * * * *

(g) ***Certified Diesel Fuel Formulations Resulting in Equivalent Emissions Reductions*.**

* * * * *

(2) ***The candidate fuel.***

* * * * *

(B) The following characteristics of the candidate fuel shall be determined as the average of three tests conducted in accordance with the referenced test method (the ASTM methods are incorporated herein by reference):

* * * * *

2. Total aromatic hydrocarbon content, by ASTM D5186-96 (through [**insert day before the effective date**]) and by ASTM D5186-03(2009) (starting [**insert effective date**]);

3. Polycyclic aromatic hydrocarbon content, by ASTM D5186-96 (through [**insert day before the effective date**]) and by ASTM D5186-03(2009) (starting [**insert effective date**]);

* * * * *

(3) ***The reference fuel.***

* * * * *

Reference Fuel Specifications

Property	*ASTM Test Method*	*General Reference Fuel Specifications*	*Small Refiner Reference Fuel Specifications*

* * * * *

Aromatic Hydrocarbon Content, Vol. %	D5186-96 (through [**insert day before effective date**])	10% max.	20% max.
	D5186-03(2009) (starting [**insert effective date**])	10% max.	20% max.
Polycyclic Aromatic Hydrocarbon content, Wt. %	D5186-96 (through [**insert day before effective date**])	1.4% max.	4% max.
	D5186-03(2009) (starting [**insert effective date**])	1.4% max.	4% max.

* * * * *

(h) ***Designated Equivalent Limits.***

(1) ***Designated equivalent limits.*** The designated equivalent limits under this section 2282 are set forth in the following table. Compliance with the limits for the properties shall be determined by the specified ASTM methods, which are incorporated herein by reference.

Property	*Equivalent Limit*	*Test Method*
Aromatic Hydrocarbon Content (% by wt.)	≤ 21.0	ASTM D5186-96 (through [**insert day before effective date**]) ASTM D5186-03(2009) (starting [**insert effective date**])
PAH Content (% by wt.)	≤ 3.5	ASTM D5186-96 (through [**insert day before effective date**]) ASTM D5186-03(2009) (starting [**insert effective date**])
* * * * *		

* * * * *

Note: Authority cited: Sections 39600, 39601, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39010, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).