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AB 237
(BDR 796)

Removal of low-sulfur diesel from NRS 445A

In 2002, the United States Environmental Protection Agency (USEPA) prepared the Health Assessment Document for Diesel Engine Exhaust. The assessment concluded that "long-term inhalation exposure is likely to **pose a lung cancer hazard to humans**, as well as damage the lung in other ways depending on exposure." It also showed evidence of "exacerbation of existing allergies and asthma symptoms." Allergies and asthma symptoms are on the rise in both Clark and Washoe counties.

NRS 445A created an alternative fuel program that required city, county and state fleets to purchase and operate a percentage of their vehicles on alternative fuels. Low sulfur diesel (LSD) was included in the original legislation. At that time the NRS allowed 5,000ppm of sulfur in diesel fuel. LSD was defined as having sulfur concentrations of less than 500 ppm. Including it served to improve air quality in Clark and Washoe, as well as, provide an incentive to convert all diesel supplies to LSD ahead of the federal deadline.

The 2001 statewide average for sulfur in diesel fuel was 265 ppm, according to the Nevada Department of Agriculture. In 2000, the USEPA approved a new diesel standard that creates Ultra Low Sulfur Diesel (ULSD) with a maximum amount of sulfur at 15 ppm and takes effect for on-road vehicles in 2007. The USEPA is seeking to work with local authorities to improve the availability of ULSD in advance of the deadline. The USEPA expects significant public health and environmental benefits as the environmental performance of diesel engines and diesel fuels improve.

In the 2001 session, Senator Titus introduced SB 177 intended to remove LSD from NRS 445A. It met opposition as the only alternative for public transit and school buses were natural gas powered buses that are tens of thousands more per bus and required additional infrastructure. Since then, prices have come down on natural gas buses, the natural gas infrastructure has been expanded in Clark County and a variety of other fuels have become available including CARB Diesel and Ultra Low Sulfur Diesel.

AB 237 seeks to remove LSD from NRS 445A and provides a variety of fuels for fleet operators to use to meet the requirements. This program only applies to the acquisition of city, county and state vehicles, not the existing fleet. We should not purchase vehicles running on Low Sulfur Diesel with taxpayer money under the guise of improving air quality. I encourage you to approve AB 237 as amended.

Respectfully,
Jason Geddes, Ph.D.
Assembly District 24 – Washoe County

Fiscal Notes:
You will see a fiscal note on the cost to fleets. I believe that the estimation for the impact has been overestimated on the high side. The first thing to remember is that this only applies to 90% of vehicle acquisitions, not the existing fleet. You have been provided a copy of the withdrawal of the state fiscal note. Secondly, an analysis of fuel costs in the Western United States per the OPIS rates on April 22 shows:

	Per gallon, pre-tax	Increase
Low Sulfur Diesel	$0.9823	
Ultra Low Sulfur Diesel	$1.0853	10.5% (0.103)
CARB Diesel	$0.9796	-0.2% (0.002)
B5 Biodiesel	$1.0139	3.3% (0.032)
B20 Biodiesel	$1.1088	12.9% (0.127)

Clark County	$490,000	$0	No mobile tank necessary
City of Henderson	$600,000	$0	ULEV's are in the program

Some fleets in Clark County have contracted for cheaper biodiesel rates based on biodiesel production facilities being located. City of Las Vegas is only paying 5-8 cents more per gallon for B20 Biodiesel.

There are currently 6,116 vehicles in the program.

CNG	1298 (21.2%)
Diesel	2270 (37.1%)
BioDiesel(B20)	671 (11.0%)
RFG	1665 (27.2%)
Propane	159 (2.6%)
ULEV	27 (0.4%)
Hybrids	26 (0.4%)

In the presentation before Assembly Natural Resources, Agriculture and Mining the following supported passage of the legislation:

Regional Transportation Commissions in Clark County and Washoe County
Berry Hinkley Industries — Western States Petroleum Association
Sierra Club — Nevada Division of Environmental Protection
Dept of Agriculture — Washoe County Health District
School Districts in Clark and Washoe Counties (Washoe concerned about fiscal note.)
Nevada Motor Transport Association
Nevada Petroleum Marketers and Convenience Store Association

EPA/600/8-90/057F
May 2002

Health Assessment Document for Diesel Engine Exhaust

National Center for Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC

DISCLAIMER

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ABSTRACT

This assessment examined information regarding the possible health hazards associated with exposure to diesel engine exhaust (DE), which is a mixture of gases and particles. The assessment concludes that long-term (i.e., chronic) inhalation exposure is likely to pose a lung cancer hazard to humans, as well as damage the lung in other ways depending on exposure. Short-term (i.e., acute) exposures can cause irritation and inflammatory symptoms of a transient nature, these being highly variable across the population. The assessment also indicates that evidence for exacerbation of existing allergies and asthma symptoms is emerging. The assessment recognizes that DE emissions, as a mixture of many constituents, also contribute to ambient concentrations of several criteria air pollutants including nitrogen oxides and fine particles, as well as other air toxics. The assessment's health hazard conclusions are based on exposure to exhaust from diesel engines built prior to the mid-1990s. The health hazard conclusions, in general, are applicable to engines currently in use, which include many older engines. As new diesel engines with cleaner exhaust emissions replace existing engines, the applicability of the conclusions in this Health Assessment Document will need to be reevaluated.

Preferred citation:

U.S. Environmental Protection Agency (EPA). (2002) Health assessment document for diesel engine exhaust. Prepared by the National Center for Environmental Assessment, Washington, DC, for the Office of Transportation and Air Quality; EPA/600/8-90/057F. Available from: National Technical Information Service, Springfield, VA; PB2002-107661, and <http://www.epa.gov/ncea>.

FOREWORD

The diesel engine has been a vital workhorse in the United States, powering many of its large trucks, buses, and farm, railroad, marine, and construction equipment. Expectations are that diesel engine use in these areas will increase due to the superior performance characteristics of the engine. Diesel engine exhaust (DE), however, contains harmful pollutants in a complex mixture of gases and particulates. Human exposure to this exhaust comes from both highway uses (on-road) as well as nonroad uses of the diesel engine.

EPA started evaluating and regulating the gaseous emissions from the heavy-duty highway use of diesel engines in the 1970s and particle emissions in the 1980s. The reduction of harmful exhaust emissions has taken a large step forward because of standards issued in 2000 which will bring about very large reductions in exhaust emissions for model year 2007 heavy-duty engines used in trucks, buses, and other on-road uses. A draft of this assessment, along with the peer review comments of the Clean Air Scientific Advisory Committee, was part of the scientific basis for EPA's regulation of heavy-duty highway engines completed in December 2000. The information provided by this assessment was useful in developing EPA's understanding of the public health implications of exposure to DE and the public health benefits of taking regulatory action to control exhaust emissions. EPA anticipates developing similarly stringent regulations for other diesel engine uses, including those used in nonroad applications.

Until these regulations take effect, EPA is partnering with state and local agencies to retrofit older, dirtier, engines to make them run cleaner and to develop model programs to reduce emissions from idling engines. In addition, EPA and local authorities are working to ensure early introduction of effective technologies for particulate matter control and the availability of low- sulfur fuel where possible in advance of the 2007 requirements. Today, at least one engine manufacturer is producing new engines with particulate traps that, when coupled with low-sulfur fuel, meet 2007 particulate emission levels. The Agency expects significant environmental and public health benefits as the environmental performance of diesel engines and diesel fuels improves.

The health assessment concludes that long-term (i.e., chronic) exposure to DE is likely to pose a lung cancer hazard as well as damage the lung in other ways depending on exposure. The health assessment's conclusions are based on exposure to exhaust from diesel engines built prior to the mid-1990s. Short-term (i.e., acute) exposures can cause transient irritation and inflammatory symptoms, although the nature and extent of these symptoms are highly variable across the population. The assessment also states that evidence is emerging that diesel exhaust exacerbates existing allergies and asthma symptoms. The assessment recognizes that DE emissions, as a mixture of many constituents, also contribute to ambient concentrations of several criteria air pollutants including nitrogen oxides, sulfur oxides, and fine particles, as well as other hazardous air pollutants.

The particulate fraction of DE and its composition is a key element in EPA's present understanding of the health issues and formulation of the conclusions in the health assessment. The amount of exhaust particulate from on-road engines has been decreasing in recent years and is expected to decrease 90% from today's levels with the engines designed to meet the 2007 regulations. The composition of the exhaust particulates and the gases also will change. While EPA believes that the assessment's conclusions apply to the general use of diesel engines today, as cleaner diesel engines replace a substantial number of existing engines, the general applicability of the conclusions in this health assessment document will need to be reevaluated.

Paul Gilman

Paul Gilman, Ph.D.
Assistant Administrator
Office of Research and Development

EPA420-P-02-001
October 2002

A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions

Draft Technical Report

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments which may form the basis for a final EPA decision, position, or regulatory action.

Nature and Purpose of This Technical Report

This Report presents a technical analysis of the effect of biodiesel on exhaust emissions from diesel-powered vehicles. It analyzes pre-existing data from various emissions test programs to investigate these effects. The conclusions drawn in this Technical Report represent the current understanding of this specific technical issue, and are subject to re-evaluation at any time.

The purpose of this Technical Report is to provide information to interested parties who may be evaluating the value, effectiveness, and appropriateness of the use of biodiesel. This Report informs any interested party as to the potential air emission impacts of biodiesel. It is being provided to the public in draft form so that interested parties will have an opportunity to review the methodology, assumptions, and conclusions. The Agency will also be requesting independent peer reviews on this draft Technical Report from experts outside the Agency.

This Technical Report is not a rulemaking, and does not establish any legal rights or obligations for any party. It is not intended to act as a model rule for any State or other party. This Report is by its nature limited to the technical analysis included, and is not designed to address the wide variety of additional factors that could be considered by a State when initiating a fuel control rulemaking. For example, this Report does not consider isues such as air quality need, cost, cost effectiveness, technical feasibility, fuel distribution and supply impacts, regional fleet composition, and other potentially relevant factors.

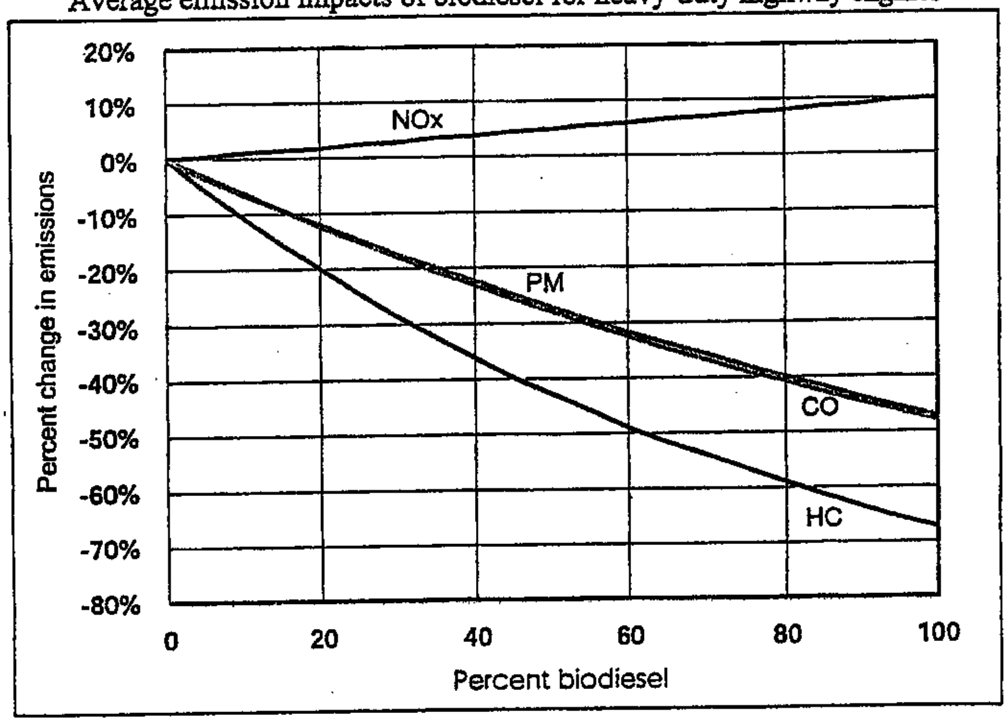
State or local controls on motor vehicle fuels are limited under the Clean Air Act (CAA) - certain state fuel controls are prohibited under the Clean Air Act, for example where the state control applies to a fuel characteristic or component that EPA has regulated (see CAA Section 211(c)(4)). This prohibition is waived if EPA approves the State fuel control into the State Implementation Plan (SIP). EPA has issued guidance describing the criteria for SIP approval of an otherwise preempted fuel control. See "Guidance on the Use of Opt-in to RFG and Low RVP Requirements in Ozone SIPs," (August, 1997) at: http://www.epa.gov/otaq/volatility.htm.

The SIP approval process, a notice and comment rulemaking, would also consider a variety of technical and other issues in determining whether to approve the State fuel control and what emissions credits to allow. An EPA Technical Report like this one can be of value in such a rulemaking, but the SIP rulemaking would need to consider a variety of factors specific to the area, such as fleet make-up, refueling patterns, program enforcement and any other relevant factors. Additional evidence on emissions effects that might be available could also be considered. The determination of emissions credits would be made when the SIP rulemaking is concluded, after considering all relevant information. While a Technical Report such as this may be a factor in such a rulemaking, the Technical Report is not intended to be a determination of SIP credits for a State fuel program.

Executive Summary

Due to the increasing interest in the use of biodiesel, the Environmental Protection Agency has conducted a comprehensive analysis of the emission impacts of biodiesel using publicly available data. This investigation made use of statistical regression analysis to correlate the concentration of biodiesel in conventional diesel fuel with changes in regulated and unregulated pollutants. Since the majority of available data was collected on heavy-duty highway engines, this data formed the basis of the analysis. The average effects are shown in Figure ES-A.

Figure ES-A
Average emission impacts of biodiesel for heavy-duty highway engines



One of the most common blends of biodiesel contains 20 volume percent biodiesel and 80 volume percent conventional diesel. For soybean-based biodiesel at this concentration, the estimated emission impacts for the current fleet are shown in Table ES-A.

Table ES-A
Emission impacts of 20 vol% biodiesel
for soybean-based biodiesel added to an average base fuel

	Percent change in emissions
NOx	+ 2.0 %
PM	- 10.1 %
HC	- 21.1 %
CO	-11.0 %

Biodiesel is also predicted to reduce fuel economy by 1-2 percent for a 20 volume percent biodiesel blend. Aggregate toxics are predicted to be reduced, but the impacts differ from one toxic compound to another. We were not able to identify an unambiguous difference in exhaust CO_2 emissions between biodiesel and conventional diesel. However, it should be noted that the CO_2 benefits commonly attributed to biodiesel are the result of the renewability of the biodiesel itself, not the comparative exhaust CO_2 emissions. An investigation into the renewability of biodiesel was beyond the scope of this report.

We have high confidence in these estimates for the current fleet. However, the database contained no engines equipped with exhaust gas recirculation (EGR), NOx adsorbers, or PM traps. In addition, approximately 98% of the data was collected on 1997 or earlier model year engines. We made an attempt to estimate the impacts that biodiesel might have on EGR-equipped engines by investigating cetane effects of biodiesel, and we have no reason to believe that biodiesel will have substantially different impacts on emissions from the effects shown above for engines having NOx adsorbers or PM traps. Still, our estimates of biodiesel impacts on emissions may be less accurate for future fleets than they are for the current fleet.

The investigation also discovered that biodiesel impacts on emissions varied depending on the type of biodiesel (soybean, rapeseed, or animal fats) and on the type of conventional diesel to which the biodiesel was added. With one minor exception, emission impacts of biodiesel did not appear to differ by engine model year.

The highway engine-based correlations between biodiesel concentration and emissions were also compared to data collected on nonroad engines and light-duty vehicles. On the basis of this comparison, we could not say with confidence that either of these groups responded to biodiesel in the same way that heavy-duty highway engines do. Thus we cannot make any predictions concerning the impacts of biodiesel use on emissions from light-duty diesel vehicles or diesel-powered nonroad equipment.

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TECHNICAL STATEMENT ON THE USE OF BIODIESEL FUEL IN COMPRESSION IGNITION ENGINES

Introduction

The Engine Manufacturers Association ("EMA") is an international membership organization representing the interests of manufacturers of internal combustion engines.

In 1995, EMA published a "Statement on the Use of Biodiesel Fuels for Mobile Applications." Since that time, increased worldwide interest in reducing reliance on petroleum-based fuels and improving air quality has led many stakeholders, including engine manufacturers, to continue to investigate the use of alternative, renewable fuels, including biodiesel fuels, as a substitute for conventional diesel fuel. In addition, recent government proposals in the United States and Europe have called for incentives or mandates to increase the production and use of such renewable fuels.

This Statement, which takes into consideration additional laboratory and field research conducted since the publication of the 1995 Statement, sets forth EMA's position on the use of biodiesel fuels with current engine technologies. It should be noted, however, that only limited data is available regarding the use of biodiesel with those technologies that have been, or are about to be, introduced to meet the (US) Environmental Protection Agency's ("EPA's") 2004 heavy-duty on-highway emission standards. Moreover, because of the absence of available data, the Statement does not address the potential use of biodiesel fuels with advanced emission control technologies, including aftertreatment systems designed for future ultra-low emission engines.

Biodiesel

Biodiesel fuels are methyl or ethyl esters derived from a broad variety of renewable sources such as vegetable oil, animal fat and cooking oil. Esters are oxygenated organic compounds that can be used in compression ignition engines because some of their key properties are comparable to those of diesel fuel.

"Soy Methyl Ester" diesel ("SME" or "SOME"), derived from soybean oil, is the most common biodiesel in the United States. "Rape Methyl Ester" diesel ("RME"), derived from rapeseed oil, is the most common biodiesel fuel available in Europe. Collectively, these fuels are sometimes referred to as "Fatty Acid Methyl Esters" ("FAME").

Biodiesel fuels are produced by a process called transesterification, in which various oils (triglycerides) are converted into methyl esters through a chemical reaction with methanol in the presence of a catalyst, such as sodium or potassium hydroxide. The by-products of this chemical reaction are glycerols and water, both of which are undesirable and need to be removed from the fuel along with traces of the methanol,

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unreacted triglycerides and catalyst. Biodiesel fuels naturally contain oxygen, which must be stabilized to avoid storage problems. Although biodiesel feedstock does not inherently contain sulfur, sulfur may be present in biodiesel fuel because of contamination during the transesterification process and in storage.

Biodiesel Specifications

Biodiesel is produced in a pure form (100% biodiesel fuel referred to as "B100" or "neat biodiesel") and may be blended with petroleum-based diesel fuel. Such biodiesel blends are designated as BXX, where XX represents the percentage of pure biodiesel contained in the blend (e.g., "B5," "B20").

Several standard-setting organizations worldwide have recently adopted biodiesel specifications. Specifically, ASTM International recently approved a specification for biodiesel referenced as D 6751. In addition, German authorities have issued a provisional specification for FAME under DIN 51606. And, Europe's Committee for Standardization ("CEN") is in the final stages of setting a technical standard for biofuels to be referred to as EN 14214. The European specifications include more stringent limits for sulfur and water, as well as a test for oxidation stability, which is absent from the current ASTM specification.

Depending on the biomass feedstock and the process used to produce the fuel, B100 fuels should meet the requirements of either ASTM D 6751 or an approved European specification, such as DIN 51606 or EN 14214 (once adopted).

In addition, it should be noted that the National Biodiesel Board has created the National Biodiesel Accreditation Commission to develop and implement a voluntary program for the accreditation of producers and marketers of biodiesel. The Commission has developed a standard entitled, "BQ-9000, Quality Management System Requirements for the Biodiesel Industry," for use in the accreditation process.

Biodiesel Blends

Public and private bodies recently have taken positions regarding the use of biodiesel blends. For example, the (United States) Energy Policy Act of 1992 ("EPAct") was amended in 1998 to allow covered fleets to use biodiesel to fulfill up to fifty percent (50%) of their annual alternative fuel vehicle (AFV) acquisition requirements. Under EPAct's Biodiesel Fuel Use Credits provisions, covered fleets are allocated one biodiesel fuel use credit (the equivalent of a full vehicle credit) for each 450 gallons of B100 purchased and consumed. Such credits are awarded only if the blended fuel contains at least twenty percent biodiesel (B20) and is used in new or existing vehicles weighing at least 8500 pounds. No credits are awarded for biodiesel used in a vehicle already counted as an AFV.

During the same time period, however, a consortium of diesel fuel injection equipment manufacturers ("FIE Manufacturers") issued a position statement concluding that blends greater than B5 can cause reduced product service life and injection equipment failures.[1] According to the FIE Manufacturers' Position Statement, even if the B100 used in a blend meets one or more specifications, "the enhanced care and attention required to maintain the fuels in vehicle tanks may make for a high risk of non-compliance to the standard during use." As a result, the FIE Manufacturers disclaim responsibility for any failures attributable to operating their products with fuels for which the products were not designed.

Based on current understanding of biodiesel fuels and blending with petroleum-based diesel fuel, EMA members expect that blends up to a maximum of B5 should not cause engine or fuel system problems, provided the B100 used in the blend meets the requirements of ASTM D 6751, DIN 51606, or EN 14214. If blends exceeding B5 are desired, vehicle owners and operators should consult their engine manufacturer regarding the implications of using such fuel.

Engine Operation, Performance and Durability

The energy content of neat biodiesel fuel is about eleven percent (11%) lower than that of petroleum-based diesel fuel (on a per gallon basis), which results in a power loss in engine operation. The viscosity range of biodiesel fuel, however, is higher than that of petroleum-based diesel fuel (1.9 – 6.0 centistokes versus 1.3 – 5.8 centistokes), which tends to reduce barrel/plunger leakage and thereby slightly improve injector efficiency. The net effect of using B100, then, is a loss of approximately five to seven percent (5-7%) in maximum power output. The actual percentage power loss will vary depending on the percentage of biodiesel blended in the fuel. Any adjustment to the engine in service to compensate for such power loss may result in a violation of EPA's anti-tampering provisions. To avoid such illegal tampering, as well as potential engine problems that may occur if the engine is later operated with petroleum-based diesel fuel, EMA recommends that users not make such adjustments.

Neat biodiesel and higher percentage biodiesel blends can cause a variety of engine performance problems, including filter plugging, injector coking, piston ring sticking and breaking, elastomer seal swelling and hardening/cracking, and severe engine lubricant degradation. At low ambient temperatures, biodiesel is thicker than conventional diesel fuel, which would limit its use in certain geographic areas. In addition, elastomer compatibility with biodiesel remains unclear; therefore, when biodiesel fuels are used, the condition of seals, hoses, gaskets, and wire coatings should be monitored regularly.

There is limited information on the effect of neat biodiesel and biodiesel blends on engine durability during various environmental conditions. More information is needed to assess the viability of using these fuels over the mileage and operating periods typical of heavy-duty engines.

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[1] See, "Diesel Fuel Injection Equipment Manufacturers Common Position Statement on Fatty Acid Methyl Ester Fuels as a Replacement or Extender for Diesel Fuels" (May 1, 1998).

Emission Characteristics

In October 2002, U.S. EPA released a draft report entitled, "A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions." The draft technical report can be found on the EPA Web site at: http://www.epa.gov/otaq/models/biodsl.htm.

Use of neat biodiesel and biodiesel blends in place of petroleum-based diesel fuel may reduce visible smoke and particulate emissions, which are of special concern in older diesel engines in non-attainment areas. In addition, B100 and biodiesel blends can achieve some reduction in reactive hydrocarbons ("HC") and carbon monoxide ("CO") emissions when used in an unmodified diesel engine. Those reductions are attributed to the presence of oxygen in the fuel. Oxygen and other biodiesel characteristics, however, also increase oxides of nitrogen ("NOx") in an unmodified engine. As a result, B100 and biodiesel blends produce higher NOx emissions than petroleum-based diesel fuel. As such, EMA does not recommend the use of either B100 or biodiesel blends as a means to improve air quality in ozone non-attainment areas.

Storage and Handling

Biodiesel fuels have shown poor oxidation stability, which can result in long-term storage problems. When biodiesel fuels are used at low ambient temperatures, filters may plug, and the fuel in the tank may thicken to the point where it will not flow sufficiently for proper engine operation. Therefore, it may be prudent to store biodiesel fuel in a heated building or storage tank, as well as heat the fuel systems' fuel lines, filters, and tanks. Additives also may be needed to improve storage conditions and allow for the use of biodiesel fuel in a wider range of ambient temperatures. To demonstrate their stability under normal storage and use conditions, biodiesel fuels, tested using ASTM D 6468, should have a minimum of 80% reflectance after aging for 180 minutes at a temperature of 150°C. The test is intended to predict the resistance of fuel to degradation at normal engine operating temperatures and provide an indication of overall fuel stability.

Biodiesel fuel is an excellent medium for microbial growth. Inasmuch as water accelerates microbial growth and is naturally more prevalent in biodiesel fuels than in petroleum-based diesel fuels, care must be taken to remove water from fuel tanks. The effectiveness of using conventional anti-microbial additives in biodiesel is unknown. The presence of microbes may cause operational problems, fuel system corrosion, premature filter plugging, and sediment build-up in fuel systems.

Health & Safety

Pure biodiesel fuels have been tested and found to be nontoxic in animal studies. Emissions from engines using biodiesel fuel have undergone health effects testing in accordance with EPA Tier II requirements for fuel and fuel additive registration. Tier II test results indicate no biologically significant short term effects on the animals studied other than minor effects on lung tissue at high exposure levels.

Biodiesel fuels are biodegradable, which may promote their use in applications where biodegradability is desired (e.g., marine or farm applications).

Biodiesel is as safe in handling and storage as petroleum-based diesel fuel.

Warranties

Engine manufacturers are legally required to provide an emissions warranty on their products (which are certified to EPA's diesel fuel specification) and, typically, also provide commercial warranties. Individual engine manufacturers determine what implications, if any, the use of biodiesel fuel has on the manufacturers' commercial warranties. It is unclear what implications the use of biodiesel fuel has on emissions warranty, in-use liability, anti-tampering provisions, and the like. As noted above, however, more information is needed on the impacts of long-term use of biodiesel on engine operations.

Economics

The cost of biodiesel fuels varies depending on the basestock, geographic area, variability in crop production from season to season, and other factors. Although the cost may be reduced if relatively inexpensive feedstock, such as waste oils or rendered animal fat, is used instead of soybean, corn or other plant oil, the average cost of biodiesel fuel nevertheless exceeds that of petroleum-based diesel fuel.

That said, users considering conversion to an alternative fuel should recognize that the relative cost of converting an existing fleet to biodiesel blends is much lower than the cost of converting to any other alternative fuel because no major engine, vehicle, or dispensing system changes are required.

Conclusions

- Depending on the biomass feedstock and the process used to produce the fuel, B100 fuels should meet the requirements of either ASTM D 6751 or an approved European specification.
- Biodiesel blends up to a maximum of B5 should not cause engine or fuel system problems, provided the B100 used in the blend meets the requirements of ASTM D 6751, DIN 51606, or EN 14214. Engine manufacturers should be consulted if higher percentage blends are desired.
- Biodiesel blends may require additives to improve storage stability and allow use in a wide range of temperatures. In addition, the conditions of seals, hoses, gaskets, and wire coatings should be monitored regularly when biodiesel fuels are used.
- Although the actual loss will vary depending on the percentage of biodiesel blended in the fuel, the net effect of using B100 fuel is a loss of approximately 5-7% in maximum power output.

- Neat biodiesel and biodiesel blends reduce particulate, HC and CO emissions and increase NOx emissions compared with petroleum-based diesel fuel used in an unmodified diesel engine. Neither B100 nor biodiesel blends should be used as a means to improve air quality in ozone non-attainment areas.
- Biodiesel fuels have generally been found to be nontoxic and are biodegradable, which may promote their use in applications where biodegradability is desired.
- Individual engine manufacturers determine what implications, if any, the use of biodiesel fuel has on the manufacturers' commercial warranties.
- Although several factors affect the cost of biodiesel fuel, its average cost exceeds that of petroleum-based diesel fuel. The relative cost of converting an existing fleet to biodiesel blends, however, is much lower than the cost of converting to other alternative fuel.

DATED: February 2003