

Guidance for Biodiesel Producers and Biodiesel Blenders/Users

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Transportation and Regional Programs Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

This guidance 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 guidance is to facilitate the exchange of technical information and to inform the public of technical developments.



Purpose

The purpose of this document is to explain and clarify EPA's regulatory requirements for biodiesel producers and biodiesel blenders/users. While the term biodiesel generally has a broad interpretation, as used in this guidance document, its meaning is directed specifically to biodiesel-ester.

Background

Use of renewable fuels, such as ethanol and biodiesel, in motor vehicle fuels has been growing rapidly for a variety of reasons. Biodiesel usage has been increasing particularly rapidly. This widespread increase in biodiesel usage has highlighted a need to promote adherence to the primary industry standard for biodiesel (B100 blendstock used to produce biodiesel blends), ASTM International (ASTM) D 6751, and consider new ASTM standards for blends of biodiesel and conventional petroleum-based diesel. EPA is also currently coordinating significant additional testing to resolve issues related to the effect of biodiesel on vehicle emissions performance.

Biodiesel is a fuel made from plant or animal feedstocks, and may be used in conventional diesel engines. Biodiesel is comprised of specific chemical components defined by ASTM as "mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats." In the United States, most biodiesel is made from soybean oil. However, canola oil, sunflower oil, recycled cooking oils, palm oil, animal fats, and other oils are also used as feedstocks.

Biodiesel is typically manufactured through a process called "trans-esterification." This process uses an industrial alcohol (typically methanol, sometimes ethanol) and a catalyst (sodium methylate, can be sodium hydroxide) to convert the base plant oil or animal fat into a fatty-acid mono-alkyl ester fuel (biodiesel), with glycerin as a byproduct. Biodiesel in its pure form is known as B100, but it can be blended with conventional diesel fuel. The most common blends are B5 (5 percent biodiesel and 95 percent conventional diesel) and B20 (20 percent biodiesel and 80 percent conventional diesel).

Biodiesel is registered with the U.S. Environmental Protection Agency (EPA) as a motor vehicle diesel fuel and motor vehicle diesel fuel additive. It is registered for use at any blend level up to B100 in highway diesel vehicles.

Biodiesel, as discussed in this document, does not include renewable diesel. Renewable diesel is a non-ester based diesel blend derived from non-petroleum resources, such as plant oil or animal fats or wastes. Because renewable diesel is processed in a refinery along with petroleum stocks, it becomes

indistinguishable from petroleum diesel, and does not need to be blended downstream of the refinery.

Neat vegetable oils and recycled greases (also called waste cooking oil or yellow grease) that have not been processed into mono-alkyl esters are not biodiesel. These raw oils, used as fuel extenders or fuel substitutes, are not registered with EPA and are not legal to use as a motor vehicle fuel. Furthermore, cooking oil is physically and chemically different than diesel fuel and its use in conventional engines will generally cause negative effects on emissions and engine durability.

Because of the potential for increased emissions, it is considered unlawful tampering to convert a vehicle designed for diesel fuel to operate on waste oil without EPA certification. To date, EPA has not certified any conversions for waste oils. Even with EPA certification, conversions may violate the terms of the vehicle warranty. For more information on the certification process, please visit EPA's Web site at: www.epa.gov/otaq/cert/dearmfr/cisd0602.pdf (22 pp, 152 K, [About PDF](#))

EPA Requirements for Biodiesel Producers under 40 CFR Part 79 and Part 80

Section 211 of the Clean Air Act provides EPA with the authority to regulate fuels and fuel additives in order to obtain information about emissions and health effects related to fuels and their additives, and where appropriate to reduce the risk to public health from exposure to their emissions. In part, regulations implementing this authority are codified in Part 79 of the Code of Federal Regulations ([40 CFR Part 79](#)), which requires that each manufacturer or importer of motor vehicle gasoline, motor vehicle diesel fuel, and their additives, have their product registered by EPA prior to its introduction into commerce. Registration involves providing a chemical description of the product and certain technical, marketing and health-effects information. This allows EPA to identify the likely combustion and evaporative emissions. In many cases, health-effects testing is required for a product to maintain its registration or before a new product can be registered. EPA uses this information to identify products whose emissions may pose an unreasonable risk to public health, warranting further investigation and/or regulation.

Producers of biodiesel for highway use are manufacturers of motor vehicle fuel or fuel additive. As part of EPA's registration process for fuel manufacturers, biodiesel producers must complete and submit EPA registration form 3520-12 (Fuel Manufacturer Notification for Motor Vehicle Fuel, available at <http://www.epa.gov/otaq/regs/fuels/ffarsfrms.htm>), and also provide the following information:

1. The feedstocks used to produce biodiesel.
2. A description of the manufacturing process used to produce biodiesel.

3. Emissions and health effects testing on the manufacturer's biodiesel, or alternatively proof of registration with the National Biodiesel Board (NBB) showing access to the Tier 1 and Tier 2 emissions and health effects testing data.
4. Test results from a representative sample of the manufacturer's biodiesel demonstrating compliance with the parameters specified in ASTM D 6751.

Since emissions and health effects testing for biodiesel is very expensive, biodiesel producers normally arrange for access to "group data" on the testing of biodiesel which is representative of all products in that group. NBB has provided EPA with the required group data on biodiesel that met the nationally accepted biodiesel standard at the time of testing, which was 1998. This standard has since been adopted as ASTM D 6751, and continues to undergo refinements. Thus, a biodiesel producer may meet EPA's emissions and health effects testing requirement for biodiesel by reaching an agreement with NBB for access to NBB's registration data, and making a certification to EPA that the producer has notified NBB of the use of NBB's data and reimbursed NBB for the use of their data. Any biodiesel producer who does not have access to NBB's data must provide EPA with its own emissions and health effects test data as part of the registration process.

In addition to registering with EPA under 40 CFR Part 79, biodiesel producers are also required to register under 40 CFR Part 80 as a refiner. This applies to both highway and nonroad biodiesel. Under 40 CFR Part 80, diesel fuel producers must complete and submit EPA registration forms 3520-20A (Fuels Programs Company/Entity Registration) and 3520-20B1 (Diesel Programs Facility Registration). Both of these forms are available at <http://www.epa.gov/otaq/regs/fuels/rfgforms.htm>.

Highway and nonroad biodiesel producers must also comply with all of EPA's regulatory requirements for diesel fuel producers in 40 CFR Part 80, Subpart I. The primary standard for diesel fuel producers in Subpart I is the 15 ppm sulfur standard, which will be phasing in for all diesel fuel from now through 2014. Although biodiesel typically contains less than 15 ppm sulfur, biodiesel producers are still required to test each of their biodiesel batches for sulfur and appropriately designate their product as required by Subpart I. Subpart I also contains diesel fuel standards for minimum cetane index (40), or a maximum aromatics content (35 volume percent), which biodiesel typically meets. Lastly, Subpart I contains reporting and recordkeeping requirements for diesel fuel manufacturers.

EPA Guidance for Biodiesel Blenders/Users

Although the Part 79 registration is for biodiesel use at any blend level up to B100 in highway diesel vehicles, ASTM D 6751 points out that a considerable amount of experience exists with blends containing 20 percent biodiesel and 80

percent conventional diesel (B20). Thus, ASTM D 6751 recommends that biodiesel blends containing more than 20 percent biodiesel should be evaluated on a case-by-case basis. ASTM D 6751 also recommends that biodiesel users consult the equipment manufacturer owner's manual regarding the suitability of using biodiesel or biodiesel blends in a particular engine or application. Many engine manufacturers currently limit warranty coverage to diesel fuel containing no more than 5 percent biodiesel.

Consumers should be careful only to buy biodiesel from a reputable dealer. Improperly processed biodiesel may contain unreacted or partially reacted oils or fats (measured by the total glycerin), which can cause the fuel to gel at higher than expected temperatures. ASTM D 6751 specifies maximum allowable concentrations of free glycerin and total glycerin. Also, consumers should be careful that they are not inadvertently purchasing straight vegetable oil instead of biodiesel. One method of ensuring quality biodiesel is to buy from producers or marketers that are certified in the voluntary national biodiesel accreditation BQ 9000 program (see <http://www.bq-9000.org/> for details).

Requirements for handling and using biodiesel may differ from requirements for petroleum-based diesel. For example, biodiesel can gel at low temperatures and may require special handling in cold climates during winter. Other possible problems that may be caused by B100 use include degradation of some fuel lines and gaskets (e.g. those made from nitrile and natural rubber) and reduced power or fuel economy. Consumers should check with their vehicle manufacturers for recommendations about biodiesel use or consult the information available on the NBB web site at <http://www.biodiesel.org/resources/fuelfactsheets/> under 'Engine Manufacturers'.

Engine manufacturers have expressed concern about degradation of biodiesel due to long storage times, which may cause biodiesel to exceed the limits in ASTM D 6751 for acid number, viscosity or sediment. For example, NBB recommends that B100 be stored for no more than 6 months before usage. The Department of Energy document "Biodiesel Handling and Use Guidelines" (available at <http://www.nrel.gov/vehiclesandfuels/npbf/pdfs/40555.pdf>.) contains a detailed discussion on the stability of B100 and B20 and is a good source of information on biodiesel in general.

Current Activities Regarding Biodiesel

Emissions Performance

Having an accurate assessment of biodiesel effects on diesel engine emissions is critical to state, regional and national organizations for making informed decisions regarding biodiesel use. EPA's 2002 review of then available test data entitled "A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions" concluded that biodiesel improves HC, CO and particulate emissions while

slightly increasing NOx. However, the magnitude of biodiesel NOx impact still remains controversial. EPA has recently shown experimentally that this impact is proportional to test cycle load. Using this information and working in cooperation with the stakeholders, EPA has developed a proposal for a Collaborative Biodiesel Emission Test Program to address the NOx issue. The funding for this test program is currently uncertain. However, we continue to believe that a well-designed study such as this is necessary to accurately determine the effect of biodiesel on emissions. In addition, EPA is currently updating the 2002 biodiesel study using test data which have become available in recent years.

Standards Harmonization

EPA is also working with several standard-setting organizations, both nationally and internationally, and other government organizations in a general effort to harmonize standards for biofuels produced from a variety of feedstocks and blended in petroleum-based fuels at various concentrations. EPA's regulations codifying the Renewable Fuel Standard Program established in the Energy Policy Act of 2005 (EPA Act) were recently finalized in 40 CFR Part 80, Subpart K, and provide significant flexibility for biofuels producers, refiners and importers to properly account for the large volumes of renewable fuels that must be blended into gasoline or diesel fuel under EPA Act. Since EPA Act does not mandate where biofuels must be produced or blended into gasoline or diesel fuel, EPA encourages other standard-setting organizations, particularly state governments, to allow biofuels producers and biofuels blenders the flexibility to decide where biofuels can be most economically produced and blended into gasoline or diesel fuel. EPA is promoting standards that will result in nationally accepted, consistent, biodiesel quality levels and blend rates.

EPA is also participating in several ongoing ASTM activities regarding biodiesel quality and standards. ASTM recently added a stability specification to ASTM D 6751 and expanded the applicability of ASTM D 6751 to all diesel fuels (ASTM D 6751 was previously applicable to just highway diesel fuel). EPA's renewable fuels program regulations, recently finalized in 40 CFR Part 80, Subpart K, require biodiesel producers to meet all specifications in the most recent version of the standard (ASTM D 6751-07) for biodiesel to be considered a renewable fuel, and included in compliance calculations under Subpart K (see 40 CFR 80.1101(h)(3) and 80.1115(b)). ASTM is also considering whether to expand their standard for petroleum-based diesel fuel (ASTM D 975) to include diesel blends that contain up to 5 volume percent biodiesel, and is developing a standard for B6 to B20.

Enforcement Activities

EPA also plans to increase enforcement efforts to ensure that biodiesel producers are complying with EPA's standards, in particular ensuring that all biodiesel meets ASTM D 6751. Section 211(a) of the Clean Air Act gives the

Administrator of the EPA regulatory authority to "...designate any fuel or fuel additive...and...no manufacturer or processor of any such fuel or fuel additive may sell, offer for sale, or introduce into commerce such fuel or additive unless the Administrator has registered such fuel or additive...." This is codified in EPA's regulations at 40 CFR 79.4(a)(1), which state that "no manufacturer of fuel designated under this part shall ... sell, offer for sale, or introduce into commerce such fuel unless the Administrator has registered such fuel."

ASTM D 6751 was first published in 2002 (ASTM D 6751-02). Since then it has been periodically revised and updated. EPA's routine practice has been to register biodiesel that meets the version of ASTM D 6751 in effect at the time of registration. Because most biodiesel has been registered with EPA since 2002, EPA expects that most biodiesel will meet either ASTM D 6751-02, or later versions of ASTM D 6751. For biodiesel registered since 2002, any biodiesel that does not meet the version of ASTM D 6751 in effect at the time of registration will be considered an unregistered fuel subject to the penalty provisions in 40 CFR 79.8 (civil penalties of up to \$32,500 per day per violation). Biodiesel registered prior to 2002 must meet the ASTM D 6751 specifications contained in its registration application, which are generally equivalent to ASTM D 6751-02. For biodiesel registered prior to 2002, any biodiesel that does not meet the ASTM D 6751 specifications contained in its registration application will be considered an unregistered fuel subject to the penalty provisions in 40 CFR 79.8 (civil penalties of up to \$32,500 per day per violation).

In addition to the provisions covering violations under 40 CFR Part 79, violations of EPA's diesel fuel standards in 40 CFR Part 80, Subpart I are covered in 40 CFR 80.610 through 80.615. EPA regulations at 40 CFR 80.4 also provide authority to EPA inspectors, who present appropriate credentials, to enter the premises of any fuel manufacturer, importer, carrier or distributor and make inspections, take samples, obtain information and records, and conduct tests to determine compliance with all of EPA's fuels regulatory requirements in 40 CFR Part 80. Any person who violates these regulations is liable to the United States for a civil penalty of up to \$32,500 per day per violation (see 40 CFR 80.5).