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# **Best Practices for Implementing a Biodiesel Program**

Prepared by University of  
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Missouri Department  
of Transportation

# FINAL REPORT

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## Best Practices for Implementing a Biodiesel Program

Prepare for  
Missouri Department of Transportation  
Organizational Results

By

Scott E. Grasmann, Ph.D.  
Associate Professor  
[grasmann@umr.edu](mailto:grasmann@umr.edu)

Sundaresan Sadashivam  
Graduate Research Assistant  
[sundaresan.sadashivam@umr.edu](mailto:sundaresan.sadashivam@umr.edu)

Engineering Management & Systems Engineering  
University of Missouri Rolla

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16. Abstract This report gives recommendations on best practices for implementing a biodiesel program. Year round operability, pricing and availability, and fuel efficiency were the specific objectives that were studied. The study was accomplished by contacting other state DOTs seeking information on their biodiesel programs, practices, and lessons learned. A list of best practices was then compiled, with added inputs from literature review. An electronic survey was sent out to the contacts to prioritize these best practices. Upon the receipt of the responses to the survey, a tool called the Analytic Hierarchy Process (AHP) was used to determine the relative importance of the alternatives for year round operability. ASTM D 6751 standard compliance for B100 and BQ-9000 accreditation are the two most important best practices for a successful biodiesel program. Other important practices include effective blending, fuel filter inspection and replacement, winter additives and kerosene blending, and a regular tank cleaning program. Block heaters in the vehicle and underground storage tanks further help smooth operation in cold weather. Implementing these best practices will also ensure the availability of good quality fuel year round.			
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## EXECUTIVE SUMMARY

Implementing the use of biodiesel has been a challenge to the Missouri Department of Transportation (MoDOT). Issues related to pricing, availability, fuel quality, and winter operability have made it difficult to meet the state legislature's requirement that 75% of MoDOT diesel is B20. In addition, fuel efficiency and impact on equipment were additional areas that needed to be addressed.

Thus, the objective of this study was to establish best practices for implementation of biodiesel programs. Specifically, the recommended practices address:

1. ensuring fuel quality and year-round operability,
2. best practices for pricing and availability, and
3. documentation on fuel efficiency, impact on equipment (including reported vehicle problems due to biodiesel), and general maintenance guidelines.

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ASTM D 6751 standard compliance for B100 and BQ-9000 accreditation are the two most important best practices for a successful biodiesel program. Other important practices include effective blending, water traps at fuel filters of the storage tanks, use of biocides, fuel filter inspection and replacement, winter additives and kerosene blending, and a regular tank cleaning program. Block heaters in the vehicle and underground storage tanks further help smooth operation in cold weather. Implementing these best practices will also ensure the availability of good quality fuel year round.

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## **1.0 INTRODUCTION**

Biodiesel is a clean burning diesel replacement fuel that can be used in the regular compression-ignition (CI) engines; and is manufactured from renewable sources like soy, canola, animal fat, and restaurant waste grease. Its major benefits include reduction of exhaust emissions, zero greenhouse gas emissions, increased lubricity, reduced dependence on imported oil, and use of renewable sources for its production. Several states in the United States (US) have already started using biodiesel at various levels, including attempts to satisfy mandates to use a certain percentage of biodiesel in state fleets. However, biodiesel offers significant challenges in terms of price, availability, quality, cold weather properties, and some maintenance issues. Thus, this study was carried out to determine the best practices for implementing a biodiesel program.

### **1.1 Background**

There are many drivers for the biodiesel industry in the US. Unlike other alternative energy options like hydrogen, the technology is readily available for immediate use. It also reduces harmful exhaust emissions by approximately 50% and, since it is made from renewable sources, helps reduce the use of fossil fuels. It fosters the economic development of agricultural regions by providing jobs and creating wealth for the farmers\* .

In comparison to other fuels, biodiesel provides improved lubricity – particularly more important with the advent of Ultra Low Sulfur Diesel (ULSD), which typically has a lower lubricity. Biodiesel has a high cetane number, which is desirable for good ignition performance in a diesel fuel. For these reasons, more and more states are beginning to use biodiesel in their state fleets. There are also many state and federal incentives and tax credits being offered upon the use of biodiesel which further foster the acceptance of biodiesel in the US.

### **1.2 Study Objectives**

Implementing the use of biodiesel has been a challenge to the Missouri Department of Transportation (MoDOT). Issues related to pricing, availability, fuel quality, and winter operability have made it difficult to meet the state legislature's requirement that 75% of MoDOT diesel is B20. In addition, fuel efficiency and impact on equipment were additional areas that needed to be addressed.

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\* Biodiesel Experience and Use among State DOT Agencies, D.S. Humburg, T.J. Hansen, L.G. Schumacher, A.K. Mahapatra, G.L. Taylor, B.T. Adams.

Thus, the objective of this study was to establish best practices for implementation of biodiesel programs. Specifically, the recommended practices address:

1. ensuring fuel quality and year-round operability,
2. best practices for pricing and availability, and
3. documentation on fuel efficiency, impact on equipment (including reported vehicle problems due to biodiesel), and general maintenance guidelines.

## 2.0 WORK PLAN

The project began February 1<sup>st</sup> 2007 with an end date of October 1<sup>st</sup> 2007. A start-up meeting was held at MoDOT in Jefferson City on February 20, 2007. In the meeting, the specific goals and scope of the project were discussed and a detailed work-plan was created related to the three objectives: 1) Year Round Operability, 2) Pricing and Availability, and 3) Fuel Efficiency and Maintenance. Each of these is briefly discussed in the following sections.

### 2.1 Year Round Operability

Missouri currently regulates biodiesel and biodiesel blends, as well as proactively tests for fuel quality. Bordering states were initially studied due to the similarity in operating requirements. Five of the eight states bordering Missouri currently regulate biodiesel or biodiesel blends; however, only one currently proactively tests biodiesel quality. Further, a complete list of states with adopted fuel specifications, biodiesel quality regulations, and testing programs, including primary contact information for state fuel quality regulation was developed.

The NBB has an established fuel quality policy based on American Society of Testing and Materials (ASTM) specification ASTM D6751<sup>†</sup>, which is used for 100 % biodiesel. In addition, National Biodiesel Board (NBB) has developed a certification (BQ 9000)<sup>‡</sup> for marketers and producers, and, in conjunction with the National Renewable Energy Laboratory (NREL)<sup>§</sup>, has established a fuel quality testing program to address the challenges of year-round operating capability. The above contacts and policies were used to establish related best practices.

### 2.2 Pricing and Availability

The review of best practices for pricing and availability began by reviewing other state-level programs. According to the Database of State Incentives for Renewable Energy<sup>\*\*</sup> (DSIRE), 23 states and the District of Columbia have implemented state-level programs to assure continued support for renewable energy resources, energy efficiency initiatives, and low-income support programs; more than half of these include funding for biomass projects. The National Association of State Energy Offices<sup>††</sup> (NASEO) provides contact information for state energy offices, which, along with individual state DOTs, were used as initial sources for state policies related to biodiesel programs (Appendix A).

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<sup>†</sup> [www.biodiesel.org/pdf\\_files/fuelfactsheets/BDSpec.PDF](http://www.biodiesel.org/pdf_files/fuelfactsheets/BDSpec.PDF)

<sup>‡</sup> [www.bq-9000.org](http://www.bq-9000.org)

<sup>§</sup> [www.nrel.gov](http://www.nrel.gov)

<sup>\*\*</sup> [www.dsireusa.org](http://www.dsireusa.org)

<sup>††</sup> [www.naseo.org](http://www.naseo.org)

As of July 07, the NBB indicates that there are eight member producers/marketers of biodiesel in Missouri, none of which are currently BQ 9000 certified (see Figure 4); however, there are four BQ 9000 certified producers in bordering states. These contacts were used to establish a visual representation of potential biodiesel supply to assist with basic pricing and availability analysis.

### **2.3 Fuel Efficiency**

The Alternative Fuels Data Center sponsored by DOE Energy Efficiency & Renewable Energy (EERE) provided the primary methodology for comparison of fuel efficiency and no additional testing was required. The data center contains a number of links to related sites, studies, and other analysis tools/methodology. Specifically, the site has a section on fuel efficiency for alternative fuels. In addition, a number of other studies were researched that are available to be used as potential benchmarks for comparison of fuel efficiency.

Upon the completion of the initial literature review and gathering some starting information, we focused on the objective of year round operability in greater detail and developed a methodology to arrive at the best practices.

### 3.0 METHODOLOGY

We focused on the objective of determining best practices for year round operability with biodiesel. This work essentially consisted of two parts as follows-

1. a questionnaire sent to the state agencies to gather information on their state biodiesel programs, practices and related issues, and
2. a survey sent to the contacts for prioritizing the list of best practice for implementing a biodiesel program.

The list of contacts (see Appendix A) were approached with questions pertaining to the biodiesel implementation in their state including policies, lessons learned, and current practices. Many of these contacts referred us to other points of contact in order to get the most relevant information. A second list was prepared from the state Department of Transportation (DOT) websites and these contacts were also approached with the same questions. Thus, a comprehensive contact list was prepared. The questions are summarized in Table 1 and transcripts of the responses are provided in Appendix B.

Table 1: Preliminary Questionnaire

No.	Questions
1	What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?
2	Where do you use the biodiesel – what are the fleets run?
3	Do you procure the biodiesel from a single source or multiple sources?
4	Did you have to go through a process of RFQ for purchasing the biodiesel?
5	Are your suppliers BQ9000 certified?
6	How do you ensure the quality? Do you insist on ASTM D6751 compliance?
7	Have you had any issues with the quality at any time?
8	Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?
9	Is your fuel choice different in winter?
10	Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

Analysis of the responses and a progress meeting with MoDOT, initiated follow-up questions as summarized in Table 2.

Table 2: Additional questions supporting the preliminary questionnaire

No.	Questions
1	Are the storage tanks underground? With heaters?
2	Any modifications to the fuel system of the vehicles?
3	How do you ensure effective blending?
4	Any issues with biodiesel storage stability?
5	What have been the primary issues that your state faced with the biodiesel usage and how were these overcome?

Based on the questionnaire responses and an extensive literature review, a list of best practices for year round operability was assembled as shown in Table 3.

Table 3: List of best practices for Year Round Operability

No.	Alternative / Best Practice
A	Vary the % of blend throughout the year
B	Require BQ-9000 compliance
C	Require ASTM D 6751 compliance for B100
D	Establish a periodic tank maintenance program
E	Implement underground storage
F	Heat the storage tanks containing B-100
G	Check the fuel filters regularly for plugging and replace if necessary in the initial days of biodiesel usage
H	Incorporate a water trap into the storage tank fuel filters
I	Require the distributor to deliver pre-blended fuel
J	Use cold flow additives and kerosene blending in winter
K	Heat the fuel system's fuel lines, filters, and tanks
L	Use biocides to prevent microbial growth in storage tanks
M	Keep the fuel tanks as full as possible to minimize condensation
N	Check for the compatibility of the % blend with engine components and change if necessary

These alternatives were then prioritized in order to aid the decision making process. To do so, an electronic survey (see Appendix C) was created and sent to the participating contacts. The contacts were asked to compare alternatives on a pair-wise basis to establish the relative importance of each criterion related to year round operability. The Analytic Hierarchy Process (AHP) was used as an initial step toward developing a prioritized list of alternatives.

Details of the survey findings and analysis of the results are provided in the next sections.

## 4.0 FINDINGS

The findings from the responses to the questionnaire sent to the contacts, from the responses to the electronic survey sent to the contacts, and from literature survey are all described in the following sections.

### 4.1 Year Round Operability

This work consisted of two sections – a questionnaire sent to the various contacts asking about their state biodiesel programs and a survey sent to the contacts to prioritize the list of best practices for year round operability. The next two sections highlight these findings.

#### 4.1.1 Findings from the Questionnaire Responses

Thirty-six of 49 states (Missouri was not questioned) responded to the questionnaire – a response rate of 73.5% as of July 07. Figure 1 provides a visual of the response. Of special importance are the responses from the neighboring states of Missouri that have similar climatic conditions as that of Missouri.

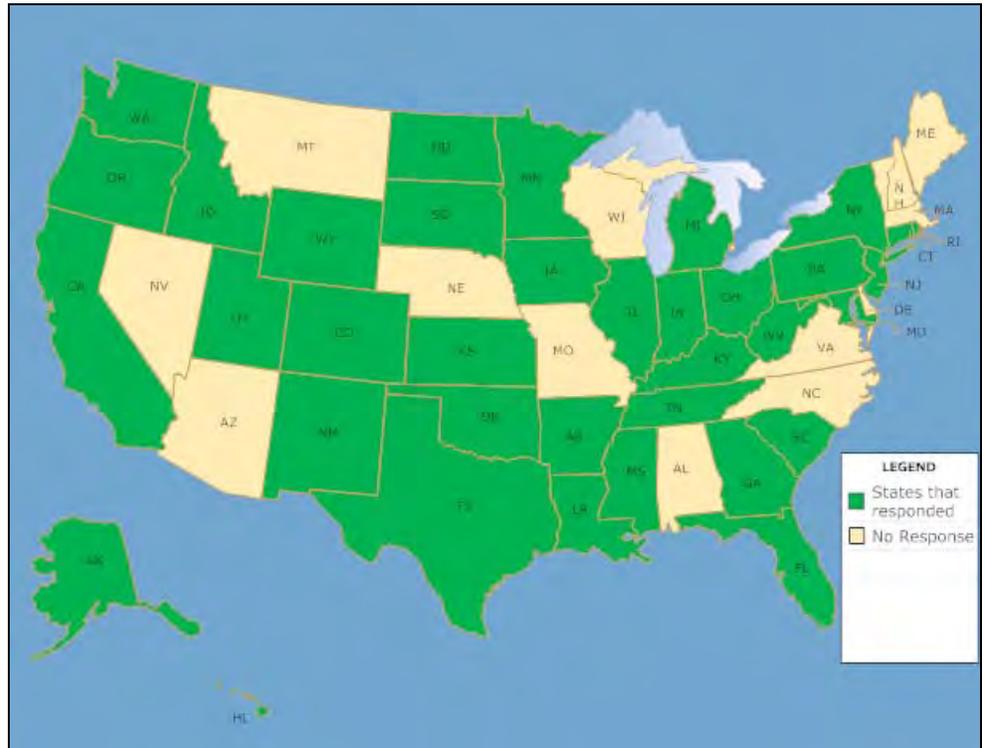


Figure 1: States that responded to the questionnaire

1. Biodiesel usage among states:

Most states have some form of biodiesel implementation. At the state program/DOT level, 20 of the 36 (55.6%) states that responded have a state funded biodiesel program. Figure 2 summarizes the biodiesel initiatives among various states.

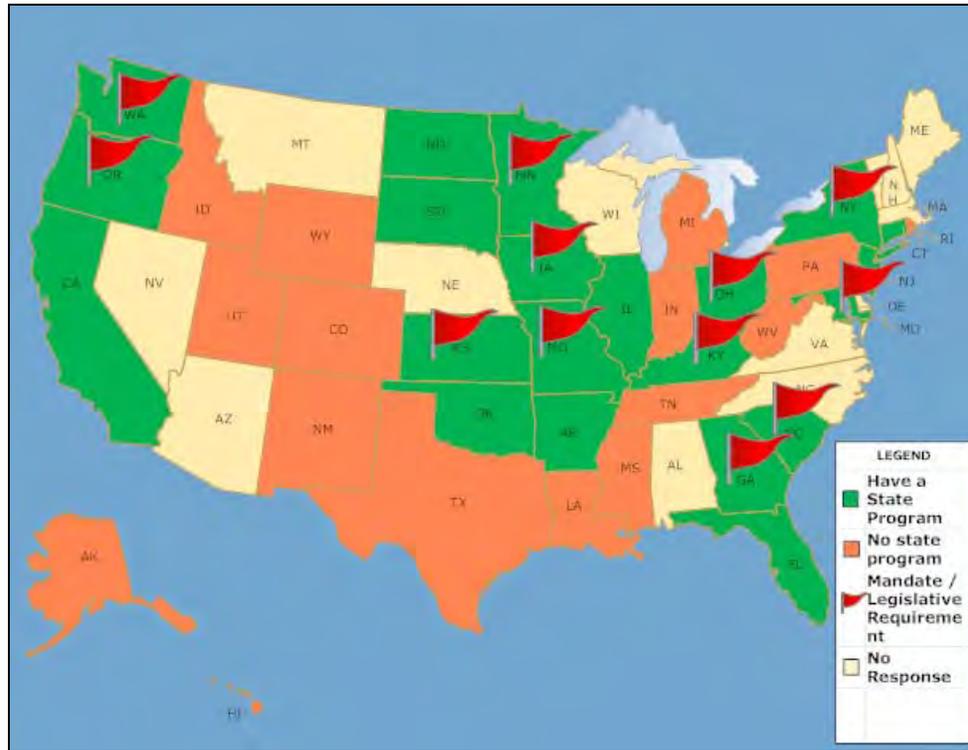


Figure 2: State Biodiesel Programs

Some states have mandates or executive orders requiring a certain percentage of biodiesel in the state fleets. Of the 19 states that responded positively for a state biodiesel program, 12 (63.2%) have a legislative requirement. These are summarized in the Table 4.

Table 4: State legislative requirements for biodiesel usage

No.	State	Policy	Requirement
1	Georgia	Executive Order	Prioritize the procurement of high fuel efficiency and flexible fuel vehicles.
2	Iowa	Executive Order # 41	Minimum of 5% of biodiesel to be purchased annually.
3	Kansas	Statute KSA 75-3744a	Minimum 2% blend to be used in state fleets as long as the price difference is no greater than 10 cents per gallon compared to regular diesel.
4	Kentucky	Executive Order	B-10 requirement
5	Maryland	Senate Bill 54	50% of diesel usage in state fleets be of

			at least a B-5 blend
6	Minnesota	Mandate	All diesel sold must be B-2
7	Missouri	Mandate	75% of all diesel used in state fleets must be B-20.
8	New York	Executive Order # 142	Minimum of B-2 as of 2007, gradually increasing to B-10 by 2012
9	Ohio	Ohio revised code 125.834	B-5 requirement
10	Oregon	Energy Action Plan	Encourage demonstration projects and create a program to use B-20 in the entire school fleet.
11	South Carolina	Legislation	B-5 in all state owned fleets
12	Washington	Executive Order 05-01	Replace standard diesel with B-20 by September 1 2009.

B20 is the preferred blend amongst most states with the exceptions of Indiana (B5), Kansas (B5), Louisiana (B2), Minnesota (B2, B5), Nebraska (B2), and South Dakota (B2, B5).

2. Winter Operation:

Most states that have a state program are able to operate year round as 14 of 19 states (73.7%) indicated that they use biodiesel all year round. However, many states lower the % of blend during winter, operating at as low as B2 or B5. States that do operate on B20 in winter are the ones that don't have a severe winter (the southern states like Florida and Georgia). It is important to note that Iowa and Ohio (that have similar winters as Missouri) have problems with B20 usage in winter. Year round operability was unclear for the states Arkansas, California, Illinois and New Jersey. Figure 3 summarizes these findings.





effect. Higher cost of the biodiesel compared to regular diesel has also been quoted as a deterrent. These are summarized in Table 5:

Table 5: Summary of major issues faced by the states with biodiesel usage

No.	State	Issues/Deterrents
1	Connecticut	Cost, Filter clogging due to a bad mixing batch
2	Florida	Cost
3	Iowa	Quality, improper blending in winter, poor equipment maintenance – all pre-date ASTM D 6751
4	Georgia	Filter clogging due to solvent effect, cold weather issues
5	Kentucky	Quality (presence of glycerin), price and availability
6	Maryland	Filter clogging due to solvent effect, winter clouding concerns
7	Minnesota	Quality (water contamination, dirt & sediments), shortage of #1 diesel for blending, and filter problems
8	North Dakota	Fuel gelling in winter, solvent effect in older storage tanks, and fuel filter clogging
9	Ohio	Fuel gelling at dispenser pumps, filter plugging due to solvent effect
10	Oregon	Cost, fuel filter clogging
11	South Carolina	Supply, Price
12	South Dakota	Filter plugging due to solvent effect, solvent effect in tanks, and winter operation.

Many of the quality issues occurred before the ASTM D 6751 standard and BQ-9000 accreditation. States following these guidelines are facing either minimal or no issues with quality. Fuel filter clogging due to solvent effect is usually addressed by periodic checks and replacing the filter as necessary. Solvent effect in storage tanks is addressed by cleaning the tanks before filling with biodiesel and also by establishing a periodic tank maintenance program. Fuel clouding and gelling in winter is addressed by blending the biodiesel with #1 diesel and/or some additives, and also by using a lower percentage of biodiesel blends.

#### 4.1.2 Findings from the Survey

With the help of the responses to the questionnaire and literature review, we developed a list of best practices for year round operability. These are briefly discussed below.

a) *Vary the % of blend throughout the year (Vary %)*

B20 has somewhat poor cold weather properties and hence causes operating issues like gelling/clouding during winter operation. A higher % of biodiesel blend can be used in spring and summer (B20) whereas the % blend in winter can be reduced to B2 or B5 in order to achieve year round operability. However, we do not recommend this, since doing so will essentially defeat the whole purpose of this study.

b) *Require BQ-9000 compliance (BQ-9000)*

Presence of water and free glycerol in the biodiesel is highly undesirable. Water favors microbial growth which in turn causes plugging of filters. Suspended water is a problem in fuel injection equipment because it contributes to the corrosion of closely fitting parts in the fuel injection system. Fuel with excessive free glycerol will usually have a problem with glycerol settling out in storage tanks, creating a very viscous mixture that can plug fuel filters and cause combustion problems in the engine. BQ – 9000 is a quality compliance program initiated by the National Biodiesel Board to ensure good quality fuel (free of water, glycerol, sediments etc) ending up in the tank.

c) *Require ASTM D 6751 compliance for B100 (ASTM)*

This is an ASTM standard specifying the acceptable limits of sediments, free and total glycerin, sulfur, cloud point, flash point etc for pure (B100) biodiesel. Any biodiesel that is used for blending with petrodiesel to make varying % of blend must meet this ASTM specifications.

d) *Establish a periodic tank maintenance program (Tank)*

Biodiesel has a solvent property and hence has a tendency to clean deposits on the inner walls of a storage tank that has been previously used to store petrodiesel. These deposits settle at the bottom and may cause problems when the fuel is to be pumped out. Microbial growth can also lead to formation of sludge at the bottom. Excess free glycerin also settles down in the tank. Hence, it is important to have a regular tank cleaning program established.

e) *Implement underground storage (Underground)*

The cloud point and cold filter plug point of biodiesel is higher than the regular petrodiesel. Hence, biodiesel has to be stored at a temperature usually above 45F. The geothermal energy of earth can be used to advantage if the storage tanks are made underground so that it keeps the biodiesel warm.

f) *Heat storage tanks containing B-100 (Heat Storage)*

Pure biodiesel has lower cold flow properties compared to regular petrodiesel and hence it has to be stored at a temperature higher than the ambient temperature.

g) *Check the fuel filters regularly for plugging and replace if necessary in the initial days of biodiesel usage. (Filters)*

Due to the solvent effect of biodiesel, it tends to clean deposits on tank walls when it is first used in a tank that was previously filled with petrodiesel. This cleaning effect could plug the fuel filters; hence, it's important to check regularly for any plugging. With continued use though, this effect is no longer seen since biodiesel doesn't form any new deposits. However, if a tank is alternatively filled with biodiesel and then petrodiesel, regular inspection is a must.

h) *Incorporate a water trap into the storage tank fuel filters (Water Trap)*

This is to prevent any carry-over of water particles into the fuel system of the vehicle.

i) *Require the distributor to deliver pre-blended fuel (Pre-blend)*

This will allow the user to know the exact % of blend rather than when blending is done at the point of use. Also, the blending must be done by an appropriate technique. Biodiesel is slightly heavier than petrodiesel and so has a tendency to settle down. Proper agitation and mixing is required so that the biodiesel is completely mixed in the petrodiesel. Splash blending, In-tank blending and In-line blending are the usual techniques adopted. In-line blending ensures complete blending before the mixture enters the tank.

j) *Use cold flow additives and kerosene blending in winter (Additives)*

Just like regular #2 petrodiesel, biodiesel should also be blended with #1 petrodiesel (kerosene) in winter to improve its cold flow properties. Other chemical additives are also available to serve this purpose.

k) *Heat the fuel system's fuel lines, filters and tanks (Heat System)*

Block heaters on the vehicle can be employed to prevent gelling/clouding of the biodiesel fuel in the fuel system of the vehicle during severe winters

l) *Use biocides to prevent microbial growth in storage tanks (Biocides)*

Microbial growth can lead to clogging of fuel filters because of the formation of sludge and sediments. This can be avoided by the use of biocides.

m) *Keep the fuel tanks as full as possible to minimize condensation (Full Tanks)*

Condensation of water in the tank is undesirable since water promotes the growth of microorganisms and also causes tank corrosion.

n) *Check for compatibility of the % blend used with engine components and change if necessary. (Compatibility)*

B100 will degrade, soften, or seep through some hoses, gaskets, seals, elastomers, glues and plastics with prolonged exposure. Nitrile rubber compounds, polypropylene, polyvinyl, and Tygon materials are particularly vulnerable to B100. There have not been significant material compatibility issues with B20 and lower % blends.

An electronic survey (see Appendix C) was sent to the contacts in order to assist with prioritization of these best practices. We used the Analytic Hierarchy Process (AHP) to compare the alternatives listed in Table 3 in a pair-wise with regard to importance for year round operability. The AHP is a basic approach<sup>‡‡</sup> to decision making. It is designed to cope with both the rational and intuitive to select the best from a number of alternatives evaluated with respect to several criteria. In this process, simple pair-wise comparisons are made which are then used to develop overall priorities for ranking the alternatives. The alternatives are scored over one another using weighting factors shown in Table 6.

Table 6: Weighting factors for AHP analysis

Option	Weighting Factor
Left hand side alternative is <b>significantly</b> more important than right hand side alternative	3
Left hand side alternative is <b>moderately</b> more important than right hand side alternative	2
Left hand side alternative is <b>slightly</b> more important than right hand side alternative	1.5
Both alternatives are equal	1
Right hand side alternative is <b>slightly</b> more important than left hand side alternative	1/1.5
Right hand side alternative is <b>moderately</b> more important than left hand side alternative	1/2
Right hand side alternative is <b>significantly</b> more important than left hand side alternative	1/3

<sup>‡‡</sup> Models, Methods, Concepts & Applications of the Analytic Hierarchy Process, Thomas L. Saaty, Luis G. Vargas

Thus, we developed a preliminary matrix of relative scores of the entire alternatives one over another as shown in Table 7. The elements of the matrix were then normalized (Table 8) and average values for each row were determined which indicates the relative importance for that particular alternative. The preliminary results are summarized in Table 9.

	Vary %	BQ-9000	ASTM	Tank	Underground	Heat Storage	Filters	Water Trap	Pre-blend	Additives	Heat System	Biocides	Full Tanks	Compatibility
Vary %	1.00	0.81	0.56	0.87	1.00	1.21	0.56	0.73	0.96	0.79	1.17	0.88	1.02	0.75
BQ-9000	1.23	1.00	0.92	1.38	1.35	1.69	1.25	0.98	1.21	1.40	1.71	1.17	1.65	1.10
ASTM	1.78	1.09	1.00	1.42	1.73	1.85	1.31	1.35	1.50	1.75	1.85	1.44	1.69	1.58
Tank	1.14	0.73	0.71	1.00	1.52	1.35	1.04	1.19	0.98	1.31	1.29	0.96	1.48	0.90
Underground	1.00	0.74	0.58	0.66	1.00	1.48	0.83	0.83	1.00	1.06	1.44	0.88	1.42	0.69
Heat Storage	0.83	0.59	0.54	0.74	0.68	1.00	0.52	0.65	0.67	0.75	1.04	0.77	0.90	0.67
Filters	1.78	0.80	0.76	0.96	1.20	1.92	1.00	0.94	1.27	1.21	1.46	1.13	1.75	1.15
Water Trap	1.37	1.02	0.74	0.84	1.20	1.55	1.07	1.00	1.19	1.10	1.54	1.10	1.15	0.79
Pre-blend	1.04	0.83	0.67	1.02	1.00	1.50	0.79	0.84	1.00	1.35	1.33	0.94	1.35	1.15
Additives	1.26	0.72	0.57	0.76	0.94	1.33	0.83	0.91	0.74	1.00	1.13	1.02	1.08	0.96
Heat System	0.86	0.59	0.54	0.77	0.70	0.96	0.69	0.65	0.75	0.89	1.00	1.00	1.00	1.02
Biocides	1.14	0.86	0.70	1.04	1.14	1.30	0.89	0.91	1.07	0.98	1.00	1.00	1.31	0.90
Full Tanks	0.98	0.61	0.59	0.68	0.71	1.12	0.57	0.87	0.74	0.92	1.00	0.76	1.00	0.92
Compatibility	1.33	0.91	0.63	1.12	1.45	1.50	0.87	1.26	0.87	1.04	0.98	1.12	1.09	1.00

Table 7: Preliminary AHP matrix

Table 8: Normalized Preliminary matrix

	Vary %	BQ-9000	ASTM	Tank	Underground	Heat Storage	Filters	Water Trap	Pre-blend	Additives	Heat System	Biocides	Full Tanks	Compatibility
Vary %	0.06	0.07	0.06	0.07	0.06	0.06	0.05	0.06	0.07	0.05	0.07	0.06	0.06	0.06
BQ-9000	0.07	0.09	0.10	0.10	0.09	0.09	0.10	0.07	0.09	0.09	0.10	0.08	0.09	0.08
ASTM	0.11	0.10	0.11	0.11	0.11	0.09	0.11	0.10	0.11	0.11	0.10	0.10	0.09	0.12
Tank	0.07	0.06	0.07	0.08	0.10	0.07	0.09	0.09	0.07	0.08	0.07	0.07	0.08	0.07
Underground	0.06	0.07	0.06	0.05	0.06	0.07	0.07	0.06	0.07	0.07	0.08	0.06	0.08	0.05
Heat Storage	0.05	0.05	0.06	0.06	0.04	0.05	0.04	0.05	0.05	0.05	0.06	0.05	0.05	0.05
Filters	0.11	0.07	0.08	0.07	0.08	0.10	0.08	0.07	0.09	0.08	0.08	0.08	0.10	0.08
Water Trap	0.08	0.09	0.08	0.06	0.08	0.08	0.09	0.08	0.09	0.07	0.09	0.08	0.06	0.06
Pre-blend	0.06	0.07	0.07	0.08	0.06	0.08	0.06	0.06	0.07	0.09	0.07	0.07	0.08	0.08
Additives	0.08	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.05	0.06	0.06	0.07	0.06	0.07
Heat System	0.05	0.05	0.06	0.06	0.04	0.05	0.06	0.05	0.05	0.06	0.06	0.07	0.06	0.08
Biocides	0.07	0.08	0.07	0.08	0.07	0.07	0.07	0.07	0.08	0.06	0.06	0.07	0.07	0.07
Full Tanks	0.06	0.05	0.06	0.05	0.05	0.06	0.05	0.07	0.05	0.06	0.06	0.05	0.06	0.07
Compatibility	0.08	0.08	0.07	0.08	0.09	0.08	0.07	0.10	0.06	0.07	0.05	0.08	0.06	0.07

Table 9: Preliminary Results from the AHP Analysis

No.	Alternative/Best Practice	% Relative Importance for Year Round Operability
1	ASTM D 6751 Compliance	10.5
2	BQ-9000 Compliance	8.8
3	Fuel Filters inspection & replacement	8.4
4	Water Trap in storage tanks	7.7
5	Tank Maintenance Program	7.6
6	Compatibility of % blend used with engine components	7.5
7	Pre-blended fuel delivered by distributor	7.2
8	Biocides to prevent microbial growth	7.0
9	Underground storage tanks	6.6

10	Additives for winter operation	6.5
11	Vary % throughout year	6.0
12	Full Tanks to minimize water condensation	5.6
13	Heated fuel system in the vehicle	5.6
14	Heated storage tanks for B-100	5.1

*Relative Importance of Best Practices*

As can be seen from Table 9, quality of the fuel appears to be the top priority in terms of best practices – with ASTM compliance and BQ-9000 compliance getting the highest relative importance. Also, fuel filter clogging during the initial days of biodiesel use is a very common issue and it appears to be the third most important best practice in terms of year round operability.

*Additional Considerations*

It should be noted that these percentages have been calculated based on the state responses. However, varying %, full tanks, heated fuel system, and heated storage tanks rank very low in terms of importance as per Table 10. Since heating the tanks containing B-100 is really a concern of the supplier and not that of MoDOT, we decided to take it off from the matrix. Also, the alternative of keeping the tanks full in order to minimize water condensation and hence microbial growth, is not very easy to implement. Moreover, if biocides are used in the tank and water traps are incorporated in the tank filters, keeping the tanks full is then not really that critical. Hence, this alternative was also discarded from the matrix. One of the ways year round operability can be achieved is to vary the % blend through the year, using lower percentage blends during winter. However, doing so defeats the main purpose of this project – to be able to operate year round at desired biodiesel blends. Hence, this alternative was also discarded. With this new set of 11 alternatives, AHP was again carried out.

**4.2 Pricing and Availability**

Most states procure their biodiesel through a state contract through a bidding mechanism. The cost of biodiesel will depend on the market dynamics, volume purchased and also on the local demand.



Figure 5: Biodiesel plant locations in US

Figure 5 above is a visual representation of location of biodiesel plants in the US and the ones that are BQ-9000 certified.

### 4.3 Fuel Efficiency and Maintenance

Only a few states of all that responded to the questionnaire admitted to formally investigating the fuel efficiency of the vehicles running on biodiesel. Amongst these were Florida, Georgia, New York, and South Dakota. Florida claimed to have gained 1 mile per gallon with the use of B20 in buses older than 1999. Rome school, Georgia has reported an anecdotal increase of about 10%. University of Georgia has seen a neutral or slightly positive effect on mileage. New York reported no difference in the mileage with the use of B20; however, it reported 1.6 – 2% reduction in energy content while using B20. As per the report, “Potential Impact of Biodiesel on SDDOT” submitted to the South Dakota Department of Transport, there was a very small reduction in the fuel economy (from 4.9 to 4.7 mpg) with the use of B5. As per the National Biodiesel Board’s report, “Biodiesel Handling and Use Guidelines,

September 2006”<sup>§§</sup>, B100 has 8% lesser energy content per gallon compared to #2 petrodiesel and B20 users experience a 1% loss in fuel economy on average and rarely report changes in torque or power.

Most states that responded indicated presence of moisture, microbial growth, and sludge deposition at the tank bottom to be of utmost concern in terms of maintenance. Different practices are followed to keep the tanks free from these impurities. Biocides are used to prevent microbial growth. States such as North Dakota, South Dakota, and South Carolina have established periodic tank maintenance programs to keep the storage tanks free from moisture, bacteria, and sludge. In terms of vehicle maintenance, some states, e.g., South Dakota, indicated the use of water traps at fuel filters to prevent water from entering into the vehicle system. Almost all states that responded indicated that they have had to change clogged fuel filters in the initial days of biodiesel usage.

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<sup>§§</sup> Biodiesel Handling and Use Guidelines, DOE/GO-102006-2358, Third Edition, September 2006, US Department of Energy, Energy efficiency and Renewable Energy.

## 5.0 RECOMMENDATIONS

The recommendations for year round operability have been classified into two groups – primary and secondary. Primary recommendations are those that are of utmost importance to implementing a successful biodiesel program. In most cases, the implementation of these primary recommendations will not require excessive capital investments. Secondary recommendations either have less relative influence on the success of the program, or those that may incur high capital investments that would require financial justification. It is recommended that MoDOT should follow the primary recommendations immediately, and further investigate secondary recommendations based upon the availability of funds.

### 5.1 Primary Recommendations

#### P1: Fuel Quality

Procuring biodiesel of the best quality is the most critical step in implementing a state program. The biodiesel blend must have been made from B100 complying with ASTM D 6751 standard and the blend itself must comply with BQ-9000 accreditation program. Also, the biodiesel blend must be blended with #1 petrodiesel and other appropriate additives for smooth winter operation. The fuel must be pre-blended and delivered by the distributor in order to ensure effective blending of the biodiesel with petrodiesel.

#### P2: Maintenance

In order to prevent microbial growth in the storage tanks, biocides must be used. Presence of water can foster the growth of microbes, enhance corrosion of the tank material and reduce the efficiency of combustion in the engine; and hence, water traps must be used with the fuel filters at the storage tank to prevent water from entering into the vehicle system.

#### P3: Vehicle considerations

Fuel filters may get clogged during the initial days of biodiesel usage due to the solvent effect on the deposits inside the tanks. Hence, the fuel filters must be regularly inspected and replaced as and when necessary. Higher percentages of biodiesel blends (greater than B20) may not be compatible with the engine components. B100 will degrade, soften, or seep through some hoses, gaskets, seals, elastomers, glues and plastics with prolonged exposure. Nitrile rubber compounds, polypropylene, polyvinyl, and Tygon materials are particularly vulnerable to B100. Sometimes, engine manufacturers void the warranty for even B20 blends. Hence, it is very essential to work with the OEMs to ensure the compatibility of the blend being used with the engine components.

## **5.2 Secondary Recommendations**

### **S1: Tank Maintenance Program**

The solvent effect of biodiesel will clean the deposits on the inner walls of the storage tanks forming sediments that settle out at the bottom. This can plug the fuel filter at the tank and also in the vehicle. Older tanks are more prone to this problem. To overcome this, it is recommended that a regular tank maintenance program be established to inspect the health of the storage tanks regularly and clean them if necessary. If possible and economically feasible, older tanks could be phased out and new tanks could be installed. Also, it is recommended that biodiesel be stored in dedicated tanks since constant switching between petrodiesel and biodiesel in the same tanks aggravates the problem of sediment formation and thereby will give rise to added cost of fuel filter replacement and tank cleaning.

### **S2: Underground storage**

It is advisable to keep the biodiesel at a temperature above its cold weather properties, and in this regard, having underground storage tank would help.

### **S3: Block Heater on the vehicle**

Also, if economically feasible, block heaters can be installed on the vehicles to overcome any cold weather issues like fuel gelling and filter plugging.

## **5.3 Additional Recommendations Related to Pricing and Availability**

In terms of availability, the two main issues are availability of BQ-9000 certified fuel and availability of good quality fuel in winter. More and more plants are going for the BQ-9000 accreditation program and hence availability of BQ-9000 certified biodiesel should not be a problem. However, availability of good quality biodiesel in winter requires implementation of the recommendations mentioned in section 4.1.3. Specifically, the quality of the fuel should be good to begin with (ASTM D 6751 and BQ-9000 compliance). Winter additives and kerosene blending must be utilized in winter to preclude any gelling/clouding issues with the biodiesel. Also of great importance is the blending method used to mix the biodiesel with the petrodiesel in cold weather. Even if the biodiesel is kept warm, if the petrodiesel is at ambient temperature (in winter), blending the two together will form snowy flakes. This can cause plugging of the filters. Though these flakes will eventually melt, it usually takes long. Other best practices like filter replacement, water traps, biocides, and tank cleaning will also further ensure availability of quality fuel in cold weather.

#### **5.4 Additional Recommendations Related to Fuel Efficiency and Performance**

In general, the loss in fuel economy of the vehicle running on B20 is not greater than 1-2%, and hence is not very significant. Quality of the biodiesel fuel is important with regard to vehicle performance. Excessive glycerin, water, and/or other sediments will have a detrimental effect on the fuel system in the vehicle. Hence, ASTM D 6751 compliance and BQ-9000 accreditation are important practices to be followed. Also, provisions must be made to preclude gelling of biodiesel in the fuel system of the vehicle in cold weather by the use of cold weather additives, blending with #1 petrodiesel, and by keeping the biodiesel warm. These practices, if followed, will prevent the performance of the biodiesel vehicle from deteriorating.

## **6.0 SUMMARY**

This report gives recommendations on best practices for implementing a biodiesel program. Year round operability, pricing and availability, and fuel efficiency were the specific objectives that were studied. The study was accomplished by contacting other state DOTs seeking information on their biodiesel programs, practices, and lessons learned. A list of best practices was then compiled, with added inputs from literature review. An electronic survey was sent out to the contacts to prioritize these best practices. Upon the receipt of the responses to the survey, a tool called the Analytic Hierarchy Process (AHP) was used to determine the relative importance of the alternatives for year round operability.

ASTM D 6751 standard compliance for B100 and BQ-9000 accreditation are the two most important best practices for a successful biodiesel program. Other important practices include effective blending, fuel filter inspection and replacement, winter additives and kerosene blending, and a regular tank cleaning program. Block heaters in the vehicle and underground storage tanks further help smooth operation in cold weather. Implementing these best practices will also ensure the availability of good quality fuel year round.

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## **APPENDIX A: CONTACTS**

## Alaska

Scott Waterman  
[swaterma@ahfc.state.ak.us](mailto:swaterma@ahfc.state.ak.us)

## Arkansas

Chris Benson  
Arkansas Energy Office  
#1 State Capitol Mall  
Little Rock, AR. 72201  
Phone: 501-682-8065  
Fax: 501-682-2703  
[cbenson@1800arkansas.com](mailto:cbenson@1800arkansas.com)

## California

Gary Yowell,  
Automotive Standards Engineer  
California Energy Commission  
916-654-4698  
916-654-4753 fax  
[Gyowell@energy.state.ca.us](mailto:Gyowell@energy.state.ca.us)

## Colorado

Gina Talmadge  
CDOT  
[Gina.Talmadge@dot.state.co.us](mailto:Gina.Talmadge@dot.state.co.us)

## Connecticut

Baron, Richard G.  
Trans. Equipment Repair Manager  
ConnDOT.O.T.  
[Richard.Baron@po.state.ct.us](mailto:Richard.Baron@po.state.ct.us)

Rabbett, John J.  
[John.Rabbett@po.state.ct.us](mailto:John.Rabbett@po.state.ct.us)

## Florida

Don Ross  
Supervisor of Vehicle Maintenance  
2800 27th Street, East  
Bradenton, FL 34208  
(941) 708.8800, 1136  
Cell Phone 737.0770  
[rossd@fc.manatee.k12.fl.us](mailto:rossd@fc.manatee.k12.fl.us)

## Georgia

Mike Malcom  
State Equipment Management Administrator  
Ga. D.O.T. - Office of Equipment  
Management  
Phone: 770-785-6947  
Mobile: 404-326-6062  
[michael.malcom@dot.state.ga.us](mailto:michael.malcom@dot.state.ga.us)

Cyrus Bhedwar  
P: 404.584.1077  
F: 404.584.1078  
[cyrus@gefa.ga.gov](mailto:cyrus@gefa.ga.gov)

## Hawaii

Priscilla C. Thompson  
Dept. of Business, Economic Development  
& Tourism  
Strategic Industries Division  
235 S. Beretania St., 5th Floor, Honolulu, HI  
96813  
Mailing Address: P.O. Box 2359, Honolulu,  
Hawaii 96804  
Phone: (808) 586-2353 Fax: (808) 586-  
2536  
[PThompso@dbedt.hawaii.gov](mailto:PThompso@dbedt.hawaii.gov)

## Idaho

Jackie McCloughan  
Fuel Systems Manager  
Idaho Transportation Department  
[Jackie.McCloughan@itd.idaho.gov](mailto:Jackie.McCloughan@itd.idaho.gov)

## Illinois

Katie Stonewater  
Office of Lieutenant Governor Pat Quinn  
414 Stratton Building  
Springfield, IL 62706  
217.782.3734  
[kate.stonewater@illinois.gov](mailto:kate.stonewater@illinois.gov)

## Indiana

Bob Timm  
Office of Equipment Management  
Indiana Department of Transportation  
[BTIMM@indot.IN.gov](mailto:BTIMM@indot.IN.gov)

**Iowa**  
May, David [DOT]  
[David.May@dot.iowa.gov](mailto:David.May@dot.iowa.gov)

**Kansas**  
Jaci Vogel, P.E.  
Asst. Bureau Chief of Const/Maint  
Kansas Department of Transportation  
Eisenhower State Office Bldg  
700 SW Harrison Street  
Topeka, KS 66603-3754  
phone (785) 296-3576  
fax (785) 296-0999  
cell (785) 231-4012  
email [Jaci@ksdot.org](mailto:Jaci@ksdot.org)

**Kentucky**  
Melissa m. Howell, executive director  
Kentucky clean fuels coalition  
P.O box 5174  
Louisville, KY 40255  
502.452.9152  
502.593.3846 cell  
Kcfc@aol.com  
[www.kentuckycleanfuels.org](http://www.kentuckycleanfuels.org)

**Louisiana**  
J. Bryan Crouch, P.E.  
Louisiana Dept. of Natural Resources  
Technology Assessment Division  
225-342-2122  
225-242-3605 (fax)  
[john.crouch@la.gov](mailto:john.crouch@la.gov)  
[www.dnr.state.la.us/tad](http://www.dnr.state.la.us/tad)

David Y. McGee, P.E., CEM  
Technology Assessment Division  
Louisiana Department of Natural  
Resources

VOX: 225/ 342-8573  
FAX: 225/ 242-3581  
[davidmc@dnr.state.la.us](mailto:davidmc@dnr.state.la.us)

**Maryland**  
Dan Guy  
Equipment Division Chief,  
Maryland State Highway Administration.  
[DGuy@sha.state.md.us](mailto:DGuy@sha.state.md.us)

**Michigan**  
Dan Smith  
Fleet Manager  
A&E Fleet Administration  
Operations Administrative Services  
MDOT  
2522 West Main St.  
Lansing , Mi. 48917  
Phone 517-334-7767  
Fax 517-334-7840  
[smithd4@michigan.gov](mailto:smithd4@michigan.gov)

**Minnesota**  
Ralph Groschen  
Minnesota Department of Agriculture  
[Ralph.Groschen@state.mn.us](mailto:Ralph.Groschen@state.mn.us)

**Mississippi**  
Willie Huff  
Director of Enforcement  
MDOT  
[whuff@mdot.state.ms.us](mailto:whuff@mdot.state.ms.us)

**New Jersey**  
Joe Biluck, Jr.  
Director of Operations and Technology  
Medford Township Board of Education  
[jbiluck@medford.k12.nj.us](mailto:jbiluck@medford.k12.nj.us)

**New Mexico**  
Tom M. Trujillo,  
Highway Equipment Manager,  
NM DOT  
[Tom.Trujillo@state.nm.us](mailto:Tom.Trujillo@state.nm.us)

## New York

Mark Austin  
Director, Office of Eq & Inv Mgmt  
NYS Thruway Authority  
200 Southern Blvd  
Albany, NY 12209  
(518) 436-2938  
[Mark\\_Austin@thruway.state.ny.us](mailto:Mark_Austin@thruway.state.ny.us)

Patrick Bolton  
Sr. Project Manager - NYSERDA  
Alternative Fuels & Vehicles  
17 Columbia Circle  
Albany, New York 12203  
(518) 862-1090 ext 3322  
(518) 862-1091 fax  
[ppb@nyserda.org](mailto:ppb@nyserda.org)  
[www.nyserda.org](http://www.nyserda.org)

## North Dakota

Paul Hanson  
NDDOT State Fleet Services  
[phanson@nd.gov](mailto:phanson@nd.gov)

## Ohio

Tim Wald, Equipment Manager  
Ohio Department of Transportation  
Office of Equipment Management  
1620 West Broad Street  
Columbus, OH 43223-1202  
614.351.2809,  
614.351.2831 (fax)  
[tim.wald@dot.state.oh.us](mailto:tim.wald@dot.state.oh.us)

Jim Zuber  
Asst.Manager/Engineering Admin.  
Ohio Department of Development  
Office of Energy Efficiency  
77 S. High St., P.O. Box 1001  
Columbus, Oh 43216-1001  
614-387-2731  
614-466-1864 (Fax)  
[jzuber@odod.state.oh.us](mailto:jzuber@odod.state.oh.us)

## Oklahoma

[twadley@isdmona.okladot.state.ok.us](mailto:twadley@isdmona.okladot.state.ok.us)

## Oregon

BROWN Gregory A \* Salem  
[Gregory.A.BROWN@odot.state.or.us](mailto:Gregory.A.BROWN@odot.state.or.us)

JAYNE Joe G  
[Joe.G.JAYNE@odot.state.or.us](mailto:Joe.G.JAYNE@odot.state.or.us)

## Pennsylvania

Lawrence H. Allen, Acting Chief  
Equipment Division  
[wheberlig@state.pa.us](mailto:wheberlig@state.pa.us)

## Rhode Island

Parker, Edmund  
[etparker@dot.ri.gov](mailto:etparker@dot.ri.gov)

## South Carolina

Wendy Bell  
[wbell@catawbacog.org](mailto:wbell@catawbacog.org)

Erika Hartwig  
Renewable Energy Coordinator  
South Carolina Energy Office  
1201 Main Street, Suite 430  
Columbia, SC 29201  
803.737.7951 (office)  
803.737.9846 (fax)  
1.800.851.8899 (toll free)  
[ehartwig@energy.sc.gov](mailto:ehartwig@energy.sc.gov)

## South Dakota

Brian J. Moore  
Internal Services Program Manger  
Becker Hansen Building  
700 East Broadway Ave.  
Pierre, SD 57501  
Desk: 605-773-3582  
Cell: 605-280-1454  
Fax: 605-773-2804  
[brian.moore@state.sd.us](mailto:brian.moore@state.sd.us)

## Tennessee

Alan Jones  
TDOT Environmental Division  
[Alan.Jones@state.tn.us](mailto:Alan.Jones@state.tn.us)

## Texas

Don Lewis  
Fleet Manager  
TxDOT, Austin  
[DLEWIS1@dot.state.tx.us](mailto:DLEWIS1@dot.state.tx.us)

Dub Taylor  
[dub.taylor@cpa.state.tx.us](mailto:dub.taylor@cpa.state.tx.us)

## Utah

Steven McCarthy  
Equipment Operations Manager  
(Cell Phone) 801-580-0055  
(Office Phone) 801-965-4122  
(Fax) 801-965-4021  
(E-Mail) [smccarthy@utah.gov](mailto:smccarthy@utah.gov)

## Vermont

Kelly Launder,  
Energy Program Manager  
Vermont Dept. of Public Service  
Phone: 802-828-4039  
Email: [kelly.launder@state.vt.us](mailto:kelly.launder@state.vt.us)

## Washington

Jeff Canaan  
Biofuels Standards Coordinator  
Weights and Measures  
Washington State Department of Agriculture  
P.O. Box 42560  
Olympia, WA 98504-2560  
(360) 902-2035  
[jcanaan@agr.wa.gov](mailto:jcanaan@agr.wa.gov)

Georgina Willner  
Washington State Department of  
Transportation  
Maintenance & Operations, TEF Office  
Ph: 360-705-7883  
[WillneG@WSDOT.WA.GOV](mailto:WillneG@WSDOT.WA.GOV)

## West Virginia

John Walker (HD)  
[jwalker@dot.state.wv.us](mailto:jwalker@dot.state.wv.us)

## Wisconsin

Susan Brown, Deputy Administrator  
Division of Energy  
[susan.brown@wisconsin.gov](mailto:susan.brown@wisconsin.gov)

## Wyoming

Dale Hoffman  
[dale.hoffman@wybusiness.org](mailto:dale.hoffman@wybusiness.org)

**APPENDIX B: QUESTIONNAIRE RESPONSES FROM STATES**

## Arkansas

I can give some of that info to you; however, most will have to come from the producers and distributors themselves. In our state that would be Patriot Biofuels (Steve Danforth, Agri Process Innovations, [steve@apinnovations.com](mailto:steve@apinnovations.com)) in Stuttgart, Arkansas and Future Fuels (Gary McDonald, [gjmcDonald@eastman.com](mailto:gjmcDonald@eastman.com)) in Batesville, Arkansas.

### **Chris Benson**

Arkansas Energy Office

#1 State Capitol Mall

Little Rock, AR. 72201

Phone: 501-682-8065

Fax: 501-682-2703

[cbenson@1800arkansas.com](mailto:cbenson@1800arkansas.com)

## California

The specific topics that you have identified are very close to the plant operations level. At the state level, we do not currently track the plant operations pricing, quality and year round operability. We are tracking gross volumes of capacity and production overall economics, investigating hurdles and opportunities, and emissions. We may be moving toward the plant operations level but don't expect to get too far. Perhaps you could call me and discuss further; and in our subsequent meetings with Biodiesel produces we may be able to uncover some particulars to help.

Regards,

**Gary Yowell,**

Automotive Standards Engineer

California Energy Commission

916-654-4698

916-654-4753 fax

## Colorado

Thank you for contacting the Colorado Department of Transportation (CDOT). CDOT has no such requirement to run 75% of its fleet on BIODIESEL.

For further information, you can contact our State Fleet Management at (303) 866-5222.

Best Regards,  
**Gina Talmadge**  
CDOT

## Connecticut

1. Is there any legislative requirement/mandate for Biodiesel in your state?

No mandate at this time.

2. Where do you use the biodiesel - what are the fleets run?

At highway maintenance locations where we have B-20, all diesel fueled equipment runs on it, from 3/4T trucks to 54,000 lb. GVWR trucks, loaders, tractors, etc.....The trucks do all of our highway maintenance work including snow and ice removal. The loaders and tractors perform off road highway maintenance work.

3. How do you procure the biodiesel?

[John Rabbett] Procurement is done thru a State Contract

4. Are your suppliers BQ9000 certified?

In our next bid specification which is being drafted, this will be a requirement.

5. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Yes. We also do random testing

6. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

We have been using B20 (Soy base feed stock) since February of 2000 and have flowed over 900,000 gallons to date, 365 days out of the year. No on or off road vehicle problems including our emergency snow & ice removal fleet.

7. Is your fuel choice different in winter? What special precautions do you take in winter?

[John Rabbett] A winter additive is added - just like when we had plain Diesel Fuel...

8. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

No data collected. However, we have not heard of any noticeable change in fuel economy or power for our application.

9. Have you established any specific tank maintenance program for biodiesel?

No. However, we have selected our newer tanks (less than 15 years old) to convert to B-20 due to the cleaning characteristics of the B20.

10. Are the storage tanks underground? With heaters?

Underground. No heaters

11. Any modifications to the fuel system of the vehicles?

No modifications to equipment at all. This was a transparent fuel change.

12. How do you ensure effective blending?

As noted in #5, we do random testing to make sure the fuel specification is being met.

[John Rabbett]Thru Random testing thru out the length of Contract. This is done by getting a sample from the Contract Vendors Truck before making delivery

13. Any issues with biodiesel storage stability?

No

14. What have been the primary issues that Connecticut faced with the biodiesel usage and how were these overcome?

We really have not faced any obstacle other than the incremental cost of the B-20 above diesel fuel. We were able to get some funding back from a grant but only for the areas in a non-attainment air quality area. The pricing has now come down to make it more inviting to use.

Just a note, when we first started to use B20, we did not tell anyone other than my repair crew and our purchasing staff that we were going to fill the diesel fuel tank with B20. We did this for a reason. We did not want to bring in the physiological issues of having the drivers run a different fuel. This way, if we were to get some feedback as to problems developing, we could link it to the B20 right away. We also wanted to test it during the winter, because we knew if there was going to be a problem, this is the time it would show up. There were no problems or issues reported from the start and none to date from the operators and repair staff.

The only problem we ever faced was related to a bad mixing batch of the B-20 which caused some filter problems at the fueling pump but not the equipment. Tank was pumped out and new fuel with B20 put in and no problems ever since.

15. In your opinion, what are the best practices for implementing a biodiesel program?

Having a very good detailed diesel fuel specification to start with and a detailed Bio-Diesel fuel specification making sure you have language about your cold weather requirements so the feed stock being used for the B20 will be conducive to winter operations. Make sure the ASTM specifications are met and add the new BQ9000 requirements. John Rabbett can provide you with other information on how to make sure you are getting a good diesel fuel.

[John Rabbett]

We have 9 locations that dispense Bio-Diesel and we have had relatively NO problems. We have been dispensing this product since 1999. Our only problems in the beginning were Dispenser Filters which we had to replace on a regular basis but now we have changed filters and are not having any problems now. Our Current Contract Vendor for Bio-Diesel Fuel is East River Energy in Guilford Ct.

**Baron Richard G**

## Florida

1. Is there any legislative requirement/mandate for Biodiesel in your state?

None

2. What was the requirement for the biodiesel program in your case?

Lack of fuel during hurricane season.

3. Where do you use the biodiesel - what are the fleets run?

Currently all 261 school buses operate on B-20 and all support fleet which is diesel also is on B-20

4. How do you procure the biodiesel? Do you procure it from a single or multiple sources? Did you have to go through a process of RFQ?

Single. Yes.

5. Are your suppliers BQ9000 certified?

Yes

6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Samples are retained for one week. Yes.

7. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

Yes. None.

8. Is your fuel choice different in winter? What special precautions do you take in winter?

Same B20.

9. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

Yes. On older buses 1999 and older we have gained 1 mile per gallon with the use of B-20.

10. Have you established any specific tank maintenance program for biodiesel?

None, how ever we do use a tank conditioner call Fuel Tek,

11. Are the storage tanks underground? With heaters?

Yes. No.

12. Have you had any issues with quality at any time?

None.

13. What have been the primary issues that Minnesota faced with the biodiesel usage and how were these overcome?

Costs. Costs. Costs.

### **Don Ross**

Supervisor of Vehicle Maintenance

2800 27th Street, East

Bradenton, FL 34208 (941) 708.8800, 1136 Cell Phone 737.0770

[rossd@fc.manatee.k12.fl.us](mailto:rossd@fc.manatee.k12.fl.us)

## Georgia

1. What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?  
Please see Executive Order attached.
2. Where do you use the biodiesel – what are the fleets run?  
School systems (~5)  
Department of Transportation  
Georgia Forestry Commission  
County governments (6-7)
3. Do you procure the biodiesel from a single source or multiple sources?  
14 jobbers supply the state's needs  
17 retail stations are available for biofuels supply.
4. Did you have to go through a process of RFQ for purchasing the biodiesel?  
No, biodiesel is provided through the state fuels contract.
5. Are your suppliers BQ9000 certified?  
No.
6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?  
Yes, see bill attached.
7. Have you had any issues with the quality at any time?  
Minor clouding issues.
8. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?  
Yes, year round use, minor clouding issues.
9. Is your fuel choice different in winter?  
No.
10. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?  
Rome school system has reported an anecdotal increase of about 10%  
University of Georgia has seen a neutral or slightly positive effect on mileage.

### Cyrus Bhedwar

p: 404.584.1077

f: 404.584.1078

[cyrus@gefa.ga.gov](mailto:cyrus@gefa.ga.gov)

An **ENERGY STAR** Partner

1. Is there any legislative requirement/mandate for Biodiesel in your state?  
Not at this time, we were asked to use by one of our Transportation Board members.

2. **Where do you use the biodiesel – what are the fleets run?**  
We have 6 in-house fueling stations in our northwest district which are using. All diesel units fueling at these stations are running biodiesel.
3. **How do you procure the biodiesel?**  
Through contract that is separate from our normal fuel contract.
4. **Are your suppliers BQ9000 certified?**  
Not at this time.
5. **How do you ensure the quality? Do you insist on ASTM D6751 compliance?**  
We only require certification from producer.
6. **Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?**  
We are using year round and in past winters had problems. This past winter our vendor began using additive in fuel in September. This allowed time for non-additive fuel to be out of system before freezing weather which eliminated past problems.
7. **Is your fuel choice different in winter? What special precautions do you take in winter?**  
See above, the only change we make is requiring additive.
8. **Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?**  
Not at this time.
9. **Have you established any specific tank maintenance program for biodiesel?**  
Not at this time.
10. **Are the storage tanks underground? With heaters?**  
Our tanks are underground with no heaters.
11. **Any modifications to the fuel system of the vehicles?**  
We have not made any modifications to our vehicles.
12. **How do you ensure effective blending?**  
We are only requiring vendor certification at this time.
13. **Any issues with biodiesel storage stability?**  
We have sufficient turnover of supply that we have not experienced any storage stability.
14. **What have been the primary issues that Georgia faced with its biodiesel program?**  
The main issues that we faced were the clogging of fuel filters on some of our older units that we were using the biodiesel in and the problems with cold weather mentioned below. For the fuel filter problems, we kept a filter in the unit and changed as needed with some units requiring that we change more than once. After a couple of months of usage, this problem went away.
15. **In your opinion, what are the best practices for implementing a biodiesel program?**

Require BQ9000 certification from the beginning and be prepared to replace fuel filters on older units.

**Mike Malcom**

State Equipment Management Administrator

Ga. D.O.T. - Office of Equipment Management

Phone: 770-785-6947

Mobile: 404-326-6062

[michael.malcom@dot.state.ga.us](mailto:michael.malcom@dot.state.ga.us)

## Hawaii

We are not aware that the State fleets currently use biodiesel. Several months ago a similar question came up and we were informed that there had been no bidders on at least one proposed purchase of biodiesel. The State contracts for fuel through a bid process.

You may view current price lists at:

<http://www4.hawaii.gov/priceapps/ShowPrice.cfm?&ShowAll=Yes>

It's my understanding that the City and County of Honolulu and Maui County have been purchasing B20 for some time. County contacts who may provide more information:

--City and County of Honolulu: Robert Primiano, (808) 484-7500, [rprimiano@honolulu.gov](mailto:rprimiano@honolulu.gov)

--County of Maui: Calvin Kobayashi, (808) 270-7141, [kal.kobayashi@co.maui.hi.us](mailto:kal.kobayashi@co.maui.hi.us)

Regards,  
Priscilla

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**Priscilla C. Thompson**

Dept. of Business, Economic Development & Tourism

Strategic Industries Division

235 S. Beretania St., 5th Floor, Honolulu, HI 96813

Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Phone: (808) 586-2353 Fax: (808) 586-2536

[www.hawaii.gov/dbedt/ert/](http://www.hawaii.gov/dbedt/ert/)

## Iowa

### 1. What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?

The biodiesel program has been mandated by a series of legislative initiatives and now by an Executive Order (#41) for more than a decade. HF 553 provided \$15,000 for purchase of biodiesel at one location in 1995. 1996 to 1998 included HF 2151 and 2421 which resulted in 23,000 gallons at 19 locations around the state. In 1999 SF 424 provided \$20,000 for the purchase of biodiesel and some was used at each of our fueling facilities (50+). SF 2256 provided another \$25,000 for two locations. SF 465 provided a source of funding from the sale of 131 EPACT credits. This generated about \$120,000 for the purchase of biodiesel. Presently we are operating under EO#41 which sets a gradual increase in the minimum percent of biodiesel that we must purchase on an annual basis. For now it is 5% but it increases to 20% in the future. This is calculated as a percent of biodiesel to the total petroleum purchased at our bulk facilities.

### 2. Where do you use the biodiesel – what are the fleets run?

We use biodiesel throughout the state in all of our diesel powered equipment.

### 3. Do you procure the biodiesel from a single source or multiple sources?

We purchase biodiesel from the low bid vendor that meets spec at each of our 50+ locations. There are many jobbers involved and they each get their biodiesel from the assorted biodiesel providers. We do not know nor try to regulate the source of the jobbers biodiesel.

### 4. Did you have to go through a process of RFQ for purchasing the biodiesel?

Yes.

### 5. Are your suppliers BQ9000 certified?

Some suppliers are BQ9000 certified but I suspect that some have yet to complete this process.

### 6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

We insist in compliance with ASTM 6751 and keep samples of each load.

### 7. Have you had any issues with the quality at any time?

We have had issues with quality, improper blending, and poor equipment maintenance. In short, we have experienced every possible type of failure at some point in our learning process.

The good news is that our stories are old and pre-date 6751. Since then, we have not had any issues at all.

The story was this: There was an off-spec load of biodiesel. It was like Vaseline and was almost impossible to pump. Since the truck driver did not know any better, he worked very hard to load his truck and with patience, "got her done". Similarly, he had a hard time getting it off the truck but with patience and lots of effort, he was able to unload his load of goo into our tanks.

Amazingly, it plugged our filters immediately and we ended up having to have the whole batch removed and discarded.

The problem is that nobody realized that the product was NOT right. If you go to a gas station and the stuff that comes out of the hose looks like Jell-O, you will stop pumping and not do your best to get it into your car. This was not the case for anybody who actually handled this batch. While the load was off spec, lack of education is what really killed us there.

There are other stories of jobbers blending 70 degree biodiesel into zero degree diesel fuel and producing waxy snowflakes. While they WILL melt in time, it usually takes a while and fairly warm temps before it all goes back into solution.

The other issue is proper infrastructure maintenance. Before biodiesel we had not properly cleaned or inspected many of our fuel dispensing facilities. Now we have them cleaned and treated for bacterial growth once a year. This is a must for many reasons and a "best practice" for any fleet.

**8. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?**

We do not run biodiesel year round. There is no supplier willing to guarantee that they are properly blending biodiesel in cold temperatures so we discontinue purchasing biodiesel in the fall and resume in the spring.

**9. Is your fuel choice different in winter?**

Our winter blend is 80% #2S15 and 20% #1S15 with an additive package typically blended at a 1:2000 ratio. There is usually some residual biodiesel in our bulk tanks but we don't really know how much since we fill and refill our tanks with non-biodiesel several times during the winter.

**10. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?**

We have no data regarding fuel efficiency.

**David May**

Iowa DOT

515-239-1059

## **Idaho**

The Idaho Transportation Department does not have a Biodiesel mandate from the legislature, however, we do have a Biodiesel program. We have been using B20 at 3 fuel sites for the last 4 years. This year with the ULSD implementation as well as some warranty issues with our equipment manufacturers, we were forced to discontinue B20 use temporarily. Low Sulfur diesel #2 was not available for winter blending and chemical winter blending caused quite a few gelling problems. We will start filling our tanks with B20 again when the weather warms up and pursue alternative winter blending plans. Though there is no indication at this time what those plans may be.

### **Jackie McCloughan**

Fuel Systems Manager  
Idaho Transportation Department  
(208-334-8094)

## **Illinois**

According to the Illinois Vehicle Code, beginning July 1, 2006 Illinois began requiring that any diesel powered vehicle owned or operated by the state, county or local government, school district, community college or public college or university, or mass transit agency use a biodiesel blend that contains at least 2% biodiesel (B2) when refueling at a bulk central fueling facility, unless the vehicle engine is designed for a higher percentage. (Illinois Vehicle Code)

Also, the Department of Central Management Services (CMS) is working to procure 2% biodiesel blends for the state's diesel fleet and investigate ways to increase availability of E85 for the state's flexible fuel vehicle (FFV) fleet. CMS is advising the Department of Commerce and Economic Opportunity (DCEO) by developing a plan to facilitate the use of E85 and B2 and expand E85 and B2 infrastructure. In addition, state employees are required to use E85 and B2 when available. (Executive Order 7, 2004)

The Governor recently signed legislation (1.12.07) requiring state agencies to purchase FFV's or vehicles that run on B5. So as it stands, state fleets must use B2 at minimum, but all recently purchased diesel vehicles must be B5.

### **Katie Stonewater**

Office of Lieutenant Governor Pat Quinn  
414 Stratton Building  
Springfield, IL 62706  
217.782.3734  
kate.stonewater@illinois.gov

## **Indiana**

As noted below, the Indiana Department of Transportation (INDOT) does not have a legislative or administrative mandate to use Biodiesel (B20) fuel at this time. INDOT does not have fuel tanks at any of its facilities and therefore, purchases exclusively from commercial stations or co-ops. We do often get fuel at these stations with a small Biodiesel content but it is mostly B5.

The Indiana Department of Transportation does not have a formal program or legislative mandate to use Biodiesel fuel. However, as we buy our fuel from commercial stations or co-ops, we often get fuel with a small Biodiesel content (mostly B5). Please feel free to contact me if you have any questions.

### **Bob Timm**

Office of Equipment Management  
Indiana Department of Transportation

## Kansas

1. Is there any legislative requirement/mandate for Biodiesel in your state?  
The Kansas DOT voluntarily began using biodiesel in April 2001 with a pilot program using 2% biodiesel. Since then, a statute was passed in our state in 2003, KSA 75-3744a, which states all bulk motor-vehicle fuels purchased by a state agency for use in a state owned motor vehicle, where available, as long as the price is no greater than 10 cents more per gallon than the price of diesel fuel, requires a 2% or higher blend of biodiesel must be purchased.  
  
Since the passage of legislation in 2003, the KDOT has used 2%, 4%, 5%, 10%, and even 20% biodiesel with no problems. Recently we have changed our policy and will procure and use a maximum of 5% biodiesel. This change in practice is due to roll out of new diesel trucks with a low sulfur diesel engine. The truck vendors will not stand behind their warranty if a blend of biodiesel greater than 5% has been used in the vehicles.
2. Where do you use the biodiesel – what are the fleets run?  
The Kansas DOT has our own diesel storage tanks at each of our maintenance garages/shops. We use the biodiesel where it is available and it meets the not greater than 10 cents more per gallon parameter. Approximately 65% of all our bulk purchases of diesel fuel are biodiesel. Not all garages/shops have a nearby supplier for biodiesel. All diesel powered equipment of our fleet use the fuel when it is available.
3. How do you procure the biodiesel?  
Each of our offices collects bids as they need to replenish our supply of diesel fuel. The biodiesel suppliers are competing with the diesel providers within the 10 cents per gallon parameter. It is not uncommon to receive biodiesel in procurement one time and the next time it is diesel. The biodiesel is stored in the same tank as our diesel fuel.
4. Are your suppliers BQ9000 certified?  
Our fuel vendors indicate they require that certification from their supplier.
5. How do you ensure the quality? Do you insist on ASTM D6751 compliance?  
We at the DOT do not verify or require ASTM compliance. Our vendors indicate they do require that their supplier is to be ASTM D6751 certified.
6. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?  
Biodiesel is used year round in our fleet. The use of biodiesel in the winter still requires the switching to a winter blend or an anti-gelling additive. We have experienced that some suppliers cannot provide a pre-blended biodiesel when the weather drops in temperature.
7. Is your fuel choice different in winter? What special precautions do you take in winter?  
See question #6.
8. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?  
We have not formally collected data or investigated the fuel efficiency of biodiesel.
9. Have you established any specific tank maintenance program for biodiesel?  
Most of our locations add an algae prevention additive monthly to the storage tank.

10. Are the storage tanks underground? With heaters?  
We have both underground and above ground diesel storage tanks. None of them have heaters.
11. Any modifications to the fuel system of the vehicles?  
No.
12. How do you ensure effective blending?  
It is the responsibility of the biodiesel supplier to provide a pre-blended product.
13. Any issues with biodiesel storage stability?  
No.

**Jaci Vogel, P.E.**

Asst. Bureau Chief of Const/Maint  
Kansas Department of Transportation  
Eisenhower State Office Bldg  
700 SW Harrison Street  
Topeka, KS 66603-3754  
phone (785) 296-3576  
fax (785) 296-0999  
cell (785) 231-4012  
email [Jaci@ksdot.org](mailto:Jaci@ksdot.org)

## Kentucky

Hope this helps...B10 requirement made by executive order of the Governor - no legislation needed. State fleet uses Biodiesel at retail sites thus there is no exclusive contract to one supplier. Any retailer that takes the state credit card and offers Biodiesel is a retailer any driver can use. One supplier in KY is BQ9000 - Griffin Industries...Owensboro Grain - coming on line in mid summer will be I am sure...peter cremer in cincy is as well. Kentucky mandates ASTM standard fuel - Ethanol Biodiesel, gasoline and diesel. Our state department of agriculture – regulations and inspections division is tasked with overseeing fuel quality state wide....verify very few states watch quality on all fuels like we do. State fleet uses all year long - fuel management is key to retailers and distributors. We have several fleets that are touting a reduction in fuel usage by about 14%. We had a producer last year that claimed he was making astm spec biodiesel – after testing by KY Dept of Agriculture and the US Dept of Energy - he was shut down...he is back up and according to KY dept of ag he meets spec - however, his business dropped like crazy for obvious reasons.....3 big issues..quality, price, availability.....

Not exactly sure what the quality issue was beyond glycerin....you would have to ask the KY dept of ag...we did not overcome the quality issues, that is the responsibility of the producer.....price and availability are not problems, but primary issues with any fuel not just biodiesel...you must have price, availability and quality to sell anything....year round operability is dependent on the blend - it is a fuel maintenance issue - as long as it is treated with kerosene like traditional diesel then gelling should not be a problem...heaters on holding tanks are also a must.....no we have not established a tank maintenance program.

### **Melissa m. Howell, executive director**

Kentucky clean fuels coalition

P.O Box 5174

Louisville, KY 40255

502.452.9152

502.593.3846 cell

[www.kentuckycleanfuels.org](http://www.kentuckycleanfuels.org)

## **Louisiana**

Louisiana doesn't have a biodiesel program at this time so answering your questions concerning implementation of such a program from a first hand perspective is not possible.

Biodiesel is available at a few locations. Farmers will buy it because it is made from a product they grow. This helps get distribution going.

When Louisiana instate production reaches 10 million gallons, B2 will be required as the average diesel product sold in the state. (The law says that 2% of diesel sales must come from biodiesel not that all diesel sold must include biodiesel.)

As a "petroleum" state there was some resistance from that quarter and a lot of misinformation was spread to the media regarding the cost to consumers. A pro-active education program could ease this. The change to very low sulfur diesel probably cost more because the biodiesel wasn't available in state at that time.

**David Y. McGee, P.E., CEM**

Technology Assessment Division

Louisiana Department of Natural Resources

VOX: 225/ 342-8573

FAX: 225/ 242-3581

## Maryland

1. **What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?**  
In 2006, the legislatures introduce Senate Bill 54 which required that, in state fleets, 50% of diesel usage be of at least a B5 blend. The Maryland State Highway Administration (SHA) had already been utilizing a B20 blend in certain maintenance facilities.
2. **Where do you use the biodiesel – what are the fleets run?**  
We use biodiesel in 20 of our 26 counties. Only the far western portion of the state is not on-line yet due to supply issues.
3. **Do you procure the biodiesel from a single source or multiple sources?**  
Our fuel is purchased through a statewide contract managed by our Department of General Services (DGS). Although I do believe it is from a single source.
4. **Did you have to go through a process of RFQ for purchasing the biodiesel?**  
Fuel contract related question should be sent to Ms. Candice Seward at [Candice.Seward@dgs.state.md.us](mailto:Candice.Seward@dgs.state.md.us).
5. **Are your suppliers BQ9000 certified?**  
See number 4
6. **How do you ensure the quality? Do you insist on ASTM D6751 compliance?**  
See number 4
7. **Have you had any issues with the quality at any time?**  
We at SHA have not had any issues.
8. **Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?**  
Yes, we use biodiesel year round, although different blends. From November to March we run B5 with additives to get the cloud point down to -30°. The remainder of the year we run B20.
9. **Is your fuel choice different in winter?**  
See number 8
10. **Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?**  
Not to date.
11. **What were the main issues that you faced?**  
Since the bio-diesel acts as a solvent, the clogging of fuel filters was a concern. To offset any potential problems, the Maryland State Highway Administration replaced fuel filters during the service on a vehicle following to the initial tank full of bio-diesel. This seemed to avoid issues with the filters. During spring, summer, fall we run B20.

The other concern was with our winter blend and bio-diesel's potential for clouding. We reduced to B5 and mixed additives to reduce the cloud-point to minus 30 degrees F. We have seemed no problems with this blend, to date.

Our tanks are underground and no we did not change our service intervals.

**Dan Guy**

Equipment Division Chief  
Maryland State Highway Administration (SHA)  
[DGuy@sha.state.md.us]

1. Biodiesel is available from distributors throughout MD at a price premium. It is not readily available at retail fueling sites (gas stations), but we recently created a biofuels infrastructure grant program to increase retail infrastructure of biodiesel and E85, so we hope to see improved access in the coming years.
2. Biodiesel has been meeting fuel quality standards in MD and is used year-round, though I know some fleets drop from a B20 to a B5 blend in winter months.
3. Fuel efficiency is comparable to regular diesel.
4. To make biodiesel more price competitive, distributors need to be able to deliver a large load... 5k-10k gallons.
5. You would have to contact distributors for data. You can find MD distributors on [www.biodiesel.org](http://www.biodiesel.org)

**Lauren Robbins**

410.260.7542

## **Michigan**

The Michigan department of transportation does not have a set percentage for the use of Bio-Diesel (B-20). Our program is to use bio-diesel when it meets our operational needs. The majority of our diesel fuel is purchased at commercial fuel stations and Bio-diesel is not yet available at most locations. The MDOT garage locations that have underground storage tanks and fuel pumps use Bio-Diesel when it is available and it meets their operational need.

### **Dan Smith**

Fleet Manager

A&E Fleet Administration

Operations Administrative Services

MDOT

2522 West Main St.

Lansing , Mi. 48917

Phone 517-334-7767

Fax 517-334-7840

## Minnesota

What were the 3 prominent issues that Minnesota faced while implementing biodiesel?

If by prominent you mean most common reasons for diesel filter problems in the winter 2005/06:

1. Our weights and measures people cited water contamination as the annually most prominent wither problem each year. In that sense, last year was no exception.
2. Other problems included dirt and other sediments, a shortage of #1 diesel fuel making it difficult to blend down #2 diesel fuel to make it suitable for use in cold weather, the increased usage of cold flow additives by people who had not had much previous experience.

There were also some problems identified with some shipments of biodiesel which did not meet ASTM specification D-6751.

This may have caused some filter problems even in B2 biodiesel blends, but it was very difficult to discern the cause of filter plugging problems since there was a variety of similar factors and symptoms being reported in locations of the country that were not using biodiesel in the winter. Subsequent to these events, Minnesota biodiesel producers became certified as BQ9000 producers with the National Biodiesel Board and this year I have not heard of off-spec biodiesel being shipped from Minnesota plants. There were also some users last year that were still using high (B20 to B100) levels of biodiesel during the onset of very cold weather that experienced cold flow problems. I believe there were fewer people that used high level blends this winter. Some who did use E20 this year and last year were not troubled with cold flow problems.

We have had very few problems reported this winter as, curiously, other states have reported problems that have been associated with the use of ultra low sulfur diesel (ULSD) which was present in Minnesota last year. This is just another reason why it has been difficult to discern which problems were attributable to biodiesel and which were caused by other causes.

For other information about the problems you might want to communicate with Mike Youngerberg from the Minnesota Biodiesel Council at Mike@mns soybean.com

As you may know, virtually all diesel in MN is blended with 2% bio.

This makes biodiesel a reality in our market. Every vendor has access year round. I don't know how restrictive your laws are, but the cost of biodiesel blends depends upon the motivation of the marketer. Bulk biodiesel often sells for less than diesel.

Before the 2% mandate, many state and local government units used 5, 10, or 20% blends and purchased biodiesel through a buyers group formed by Hennepin County.

**Ralph Groschen**

651-201-6223

## **Mississippi**

MDOT is not required to use biodiesel currently. There is no statute pending requiring the use of biodiesel.

**Willie Huff**

Director of Enforcement

MDOT

601-359-1707

## North Dakota

We manage the biodiesel program for state vehicle use from this office. We have not put a lot of detail into our program except for the instructions that we have given to our contract fuel supplier. We began using biodiesel a few years ago and have expanded the program to statewide in the spring of 2006. Because of the extreme changes in our climate from season to season and the cold flow properties of pure bio, we vary the percentage based on seasonal changes. During the summer months we use as high as a B20 blend and during the winter we use a B2 blend. During the spring and fall the blend will be somewhere in between the extremes as we transition from one season to the next. We require that our supplier only use virgin vegetable-based bio product.

1. [What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?](#)

We have not been required to use biodiesel by the legislature or governor mandate. We were approached a few years ago by a research agency within the University of North Dakota called Energy & Environmental Research Center (EERC). They asked State Fleet Services to try the World Energy product called Envirodiesel. We started out by using it in a controlled environment of just a few vehicles and expanded each year since then. The Soybean Council approached the Governor's office last year to ask for a mandate or executive order that State Fleet Services must use biodiesel, however because of our history of voluntary use, they were turned down.

2. [Where do you use the biodiesel – what are the fleets run?](#)

We use biodiesel state wide in our 11 state owned bulk facilities. This fuel is used by all on and off highway diesel powered trucks and equipment that fill at these sites.

3. [Do you procure the biodiesel from a single source or multiple sources?](#)

All of our biodiesel is procured through our fuel contract with Onyx Mansfield. They procure it from various suppliers throughout the state.

4. [Did you have to go through a process of RFQ for purchasing the biodiesel?](#)

No.

5. [Are your suppliers BQ9000 certified?](#)

I do not know the answer to this.

6. [How do you ensure the quality? Do you insist on ASTM D6751 compliance?](#)

We have left this up to Onyx Mansfield to ensure us the quality product meeting the ASTM D6751 compliance. If we would have any problems, they would be asked to provide us with that information. So far we have been operating virtually trouble free.

7. [Have you had any issues with the quality at any time?](#)

The only issues that we have had were getting the percentage of bio reduced in time for cold weather operations and we had some fuel gelling because of that. We have made changes to our program to counteract that. One other issue we had was putting biodiesel in an older storage tank, it scrubbed the tank and produced sludge that had to be pumped from the bottom of the tank.

8. [Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?](#)

We have not made any scientific comparison for fuel efficiency other than visiting with vehicle drivers and equipment operators. They usually comment that they have not noticed any difference

in power or fuel economy. When we first began using biodiesel, we purposely did not tell some of the sites that they had bio in their tank so that when we questioned them they were surprised.

#### What were the 3 most prominent issues that you faced and how did you overcome?

I will be happy to answer your questions. I am glad you asked for only three problems because that is about all that I can think of and they were easily addressed.

1. In our first year we did not take into account for usage volume at one site so we had B20 fuel in the ground when the weather turned cold and the fuel jelled in the dispensing pump. Some of the fuel had to be removed from the tank and transported to another site to be diluted with some fuel that did not have any bio in it to reduce the cold flow properties. We then dropped some new fuel into the tank to dilute the remaining bio. On top of it all, any vehicle that had filled from that tank had to be dealt with.

To eliminate the problem, we developed a step plan to vary the bio content from B2 to B20 based on the seasonal changes. The plan has been successful so far. We have B2 fuel delivered from January - March, B5 in April, B10 in May, B20 in June - July, B10 in August, B5 in September, and B2 October - December. By using these blends, we have had no winter jelling or performance problems reported. Our fuel provider has been very good in monitoring this program.

2. A couple of our older storage tanks accumulated sludge in the bottom after the introduction of bio. Apparently the bio cleaned the tanks and deposited the grease like substance on the bottom. This problem was eliminated by having someone come and pump out the sludge. We continue to check all tanks for any sludge and if anything is discovered it is removed immediately to prevent entry into the equipment.

3. Some of the equipment experienced early plugging of the fuel filters. We attributed this to cleansing of the storage tanks and the equipment fuel system. The only solution was to change the equipment fuel filters and monitor the situation. It corrected itself over a short period of time.

I failed to mention that from late October until about this time of year, the bio is blended with a winter blended fuel such as Cenex Wintermaster or Koch Arctic.

#### Are all of your tanks underground? Was this the design to begin with or did you have to change to underground?

To answer your question, all of our tanks are underground with the exception of one site at UND in Grand Forks (the coldest climate area of the state). We made no changes to our tanks and we use the same bio blends in the above ground tank that we use in the underground tanks. With a little monitoring, I believe we have created a very successful program. We use approximately 30,000 gallons of B100 per year to make approximately 425,000 gallons of blended bio-diesel used in our bulk fuel sites.

#### Tank Maintenance Program:

We have not changed our tank maintenance program since the introduction of bio-diesel. We use the electronic monitoring system to monitor the presence of moisture in the tanks and at least once a year,

usually in the fall, our facilities will pump the bottom of the tank to remove any moisture or sludge that may have accumulated and dispose of any contaminated fuel we may have.

**Paul Hanson**

Director

NDDOT State Fleet Services

Phone: 701-328-2543

Fax: 701-328-2514

[phanson@nd.gov](mailto:phanson@nd.gov)

## **New Jersey**

In terms of implementation two key factors must be considered. 1) Fuel quality, strict adherence to product specifications and blend ratios must be instilled initially with specific bid language referencing the need for periodic product sampling at the expense of the supplier. 2) Pre-integration activities must be performed by the use agent. These activities include comprehensive inspection of the fuel storage vessel(s). The vessel must be free of any accumulated water and contaminants. A desiccant dryer installed on the vent pipe to prevent the introduction of moisture laden air in the summer months.

These are only the major items. I'd be happy to speak with you in greater detail. Please feel free to contact me with any questions you may have, 609-953-5841

**Joe Biluck, Jr.**

Director of Operations and Technology  
Medford Township Board of Education

## **New Mexico**

NMDOT has not utilized bio diesel, however in 2007 there are efforts to make this a pilot project for one of our Maintenance Patrols in a rural area. We have not implemented a program yet, however we are planning a pilot project this summer in one of our Maintenance yards with a 5,000 gallon tank for Biodiesel. I am interested in receiving a copy of your results upon completion. It would be very beneficial to us as we begin this process.

**Tom M. Trujillo,**  
Highway Equipment Manager

## New York

1. What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?

An executive order was issued by the previous governor of NYS (EO-142) that has set requirements for the use of bio-fuels. The order establishes percentage requirements based on total diesel usage.

2. Where do you use the biodiesel - what are the fleets run?

We use bio-diesel in any diesel power vehicle that fuels at one of our maintenance locations with bio-diesel. This includes medium & heavy duty diesel trucks to mowing tractors, loaders and various other construction equipment.

3. Do you procure the biodiesel from a single source or multiple sources?

The fuel is purchased off of state contract and the fuel supplier will vary depending on geographic location. Prior to November of 2006 the fuel was purchased from one vendor as a statewide contract was not available. The fuel contracts are handled by the NYS Office of General Services and awarded by county.

4. Did you have to go through a process of RFQ for purchasing the biodiesel?

Due to the volume we were required to procure the fuel through a competitive process.

5. Are your suppliers BQ9000 certified?

Can't comment on BQ9000

6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Yes, the ASTM D6751 standard is specified in the fuel contracts.

7. Have you had any issues with the quality at any time?

We have not had any issues or problems that can be attributed to the use of bio-diesel that I know of.

8. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

Yes, we used bio-diesel year round. We have not had any cold weather issues that I know of. We are actually having some minor cold weather issues with ULSD but haven't had a problem with the Bio-Diesel

9. Is your fuel choice different in winter?

No, we have not altered the bio-blend for winter use, however, we require the fuel to be cut with kero & additives to meet the established cold weather flow requirements for the fuel. This year we expanded the use of bio-diesel to other regions in NYS, however, we did limit rollout to other locations until we had more experience with ULSD.

10. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

We do not run 100% bio-diesel we only run blends of B-5 & B-20. B-100 Bio-Diesel has approximately 8 to 10% percent less energy content (BTU's) than #2 diesel. When blended as B-20 that means 1.6 to 2% less energy content. We have looked at MPG information and have not seen any decrease in mileage. Being involved with highway maintenance there is a lot of idle time while in traffic set ups as well as heavy use when involved in snow and ice operations.

I hope this information was useful and if you have any question you can give me a call.

**Mark Austin**

Director, Office of Eq & Inv Mgmt  
NYS Thruway Authority  
200 Southern Blvd  
Albany, NY 12209  
(518) 436-2938

1. What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?

We had an executive order signed by the previous governor that set requirements. ([Executive order.](#))  
We had been using biodiesel previous to the order though.

2. Where do you use the biodiesel - what are the fleets run?

We have been using biodiesel in medium and heavy-duty diesel vehicles all over the state. Not just the state vehicles but private fleets as well.

Below is a case study from our transit operator in Buffalo.

([Print-Biodiesel.](#))

3. Do you procure the biodiesel from a single source or multiple sources?

For the most part we procure biodiesel off of the state fuel procurement contract. It is done by the NYS Office off General Services by county and across the state there are many different vendors.

4. Did you have to go through a process of RFQ for purchasing the biodiesel?

Yes, we must procure fuel through a competitive process.

5. Are your suppliers BQ9000 certified?

To the extent possible yes, but there have not been too many of them in the past to make for a good competitive bid.

6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Yes, always. The fuel you buy should meet the specification you set which should include the biodiesel portion meeting D6751 as amended.

7. Have you had any issues with the quality at any time?

We have had some minor issues I believe, but nothing major to date.

8. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

The biodiesel is used year round. To my knowledge there have not been any major issues to date. You must ensure that the blended biodiesel fuel supplied to you meets your cold weather specifications. If it does, you should not have any problems.

9. Is your fuel choice different in winter?

The blended biodiesel fuel must meet a winter specification.

10. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

From what I have seen from various fleets operating on blended biodiesel the fuel economy is essentially the same.

**Patrick Bolton**

Sr. Project Manager - NYSERDA

Alternative Fuels & Vehicles

17 Columbia Circle

Albany, New York 12203

(518) 862-1090 ext 3322

(518) 862-1091 fax

[ppb@nyserda.org](mailto:ppb@nyserda.org)

[www.nyserda.org](http://www.nyserda.org)

## Ohio

We are just starting our program through state owned vehicles. We do not have a RFS like Minnesota for all vehicles in the state. All of the questions that you have listed below are issues that we either have not addressed or are starting to address.

1. What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?

B5

2. Where do you use the biodiesel – what are the fleets run?

Different areas or pockets are using B5 but there is no consistency.

3. Do you procure the biodiesel from a single source or multiple sources?

Multiple sources

4. Did you have to go through a process of RFQ for purchasing the biodiesel?

Yes

5. Are your suppliers BQ9000 certified?

Not all of them

6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Ohio does not have fuel standards

7. Have you had any issues with the quality at any time?

Yes

8. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

There have been winter issues

9. Is your fuel choice different in winter?

No not with B5

10. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

From what I have seen from other higher examples there has been not been any decrease in mpg. At B5 it will be almost impossible to measure.

### **Zuber L James**

Asst. Manager/Engineering Admin.

Ohio Department of Development

Office of Energy Efficiency

77 S. High St., P.O. Box 1001

Columbus, Oh 43216-1001

614-387-2731

614-466-1864 (Fax)

[jzuber@odod.state.oh.us](mailto:jzuber@odod.state.oh.us)

1. What type of biodiesel feedstock does ODOT specify?

Our specification does not call out a specific source of feedstock whether it's virgin soybean oil, rapeseed, and recycled fryer oil, animal fat or any other source as long as it meets all specifications for quality and cold weather performance.

2. What concentration of biodiesel is ODOT using?

We have been using B20 exclusively. The US Department of Energy requires the use of B20 or greater to qualify for alternative fuel energy credits.

3. Are your suppliers BQ9000 certified?

The contract we are presently working on will require BQ9000 certification for producers.

4. Do you insist ASTM D6751 compliance?

Yes. D6751 is a contract requirement.

5. What have been the benefits using biodiesel regarding engine performance, maintenance, reduced emissions and overall fuel expenditure?

ODOT has purchased approximately 2.5 million gallons of biodiesel (B20) since 1999. The performance of biodiesel has been largely transparent. There is no discernable difference between B20 and straight diesel regarding maintenance, repair and fuel economy. We have not been able to identify any engine or vehicle performance problems or issues as a result of using B20.

6. Have you had to modify the fuel systems of the vehicles?

No, we have not done any vehicle modifications. B20 will work with the existing vehicle fuel systems. Some additional fuel filter changes are required shortly after we start using biodiesel because inherent solvent properties will clean out existing varnish in the fuel systems.

7. Have you had cold weather problems with B20?

We have had some problems with fuel gelling at the dispenser pumps, specifically in the exposed piping between the storage tank and dispenser. This may be because the fuel was mixed improperly, either at too low a temperature or splash blended at the tank location and not fully homogenized. We have not had cold weather problems with biodiesel in the vehicle. Some districts choose to run diesel fuel in the winter as a cold weather precaution.

8. How do you ensure effective blending?

The fuel contract requires the product as delivered and unloaded to meet the B20 blend requirements. Splash blending at our storage tank at the time of delivery is not acceptable. If necessary, we will random test fuel deliveries to assure compliance to specifications.

9. Have you had problems with microbial matter forming in fuel tanks?

We have not seen any significant microbial matter in fuel tanks. Over the last ten years or so, ODOT has upgraded fuel tanks. Most replacement tanks are above ground storage tanks (AST's). With smaller capacity tanks, fuel is turned over more frequently eliminating the time required for fuel to stagnate and form microbial matter.

10. Do you have separate storage tanks for biodiesel and regular diesel?

No. ODOT generally has one diesel storage tank for each location. When biodiesel is used, it is used in all diesel engines at that site.

11. Do you have a specific tank maintenance program for biodiesel?

ODOT has a contract for general fuel tank cleaning. We do not specifically require fuel tank maintenance prior to the inclusion of biodiesel. We regularly clean and inspect fuel tanks and related infrastructure as required by EPA and BUSTR.

**12. What types of vehicles do you run in your fleet?**

In our truck fleet, we have mostly International DT and HT engines. We also have a few Caterpillar and Cummins engines along with several different makes of industrial and off-road diesels.

**13. Is there any legislative requirement/mandate for biodiesel in Ohio?**

Yes. Ohio Revised Code 125.834 spells out biodiesel usage requirements. (See Attachment 1)

**14. Are there any other points of interest/best practices in dealing with biodiesel?**

Yes.

1. Make sure the biodiesel is high quality and sourced from a reputable producer. BQ9000 is an accreditation for biodiesel producers and is administered by the National Biodiesel Board. For a list of BQ9000 producers see their website.

2. Fuel mixing has to occur above 45° F. Along with mixing warm fuel, the blending should be done at the vendor's tank farm or splash blended in the transport/tank wagon to assure a fully homogenous blend prior to delivery. Mixing the fuel at the tank site is not advisable as inconsistencies in blending procedure can result in a stratified blend.

3. Require fuel quality certification for the B100 component from the vendor on every load. Certification should include free and total glycerin.

4. Have a fuel testing program in place. Testing should include:

ASTM-D-6371 Standard Test Method for Cold Filter Plugging Point

ASTM-D-2500 Test Method for Cloud Point of Petroleum Oils

ASTM-D-4057 Standard Practice for Manual Sampling of Petroleum Products (including pulling samples from various levels in the tank and measuring specific gravity to determine biodiesel concentration and consistency of the blend.)

**Tim Wald, Equipment Manager**

Ohio Department of Transportation

Office of Equipment Management

1620 West Broad Street

Columbus, OH 43223-1202

614.351.2809,

614.351.2831 (fax)

[tim.wald@dot.state.oh.us](mailto:tim.wald@dot.state.oh.us)

## Oklahoma

The Oklahoma Department of Transportation began a pilot project using bio-Diesel at our Talihina Maintenance facility in July, 2004. This site in southeastern Oklahoma was chosen because the remote location insured that the 16 diesel vehicles and equipment were fueled one hundred percent from this location. Additionally, little or no drop-in fueling takes place.

A B20 was specified in accordance with ASTM D6751-02. (20% Bio-Diesel blended with 80% Number 2 Low Sulphur).

A wide range of equipment types with ages ranging from 1984 models, up to 2006 models utilized the Bio-Diesel. These represent natural aspirated and turbo charged engine models. The newer models contain electronic engine controls.

After approximately one year with no problems or complaints, a second location was selected. The Central Garage in Oklahoma City began Bio-Diesel use in May, 2005. At this location, 12 diesel powered vehicles with statewide duties provided experience mixing fueling locations with Bio-Diesel and regular diesel fueling. After one year these vehicles have not reported any problems or complaints.

In July, 2005, a third location, the Lawton Maintenance facility with 22 diesel powered vehicles and equipment began Bio-Diesel use. To date, no problems or complaints have been reported.

In October 2006, a fourth location, the Woodward Maintenance facility with 17 diesel powered vehicles and equipment began using bio-diesel. To date, no problems have been reported.

Approximately 30,000 gallons of Bio-Diesel was utilized in 2005, and approximately 42,000 gallons utilized in 2006. Through our fuel management contract, we have conducted laboratory testing to confirm cold weather capabilities of -15 degrees below zero operating temperatures using a diesel fuel antigel additive.

Below are the types of equipment we are operating on Bio-Diesel at the various locations:

### **TALIHINA MAINTENANCE FACILITY**

#### 16 Diesel Powered Units

- 2 Tractor Loader Backhoes
- 1 Rotary Broom
- 2 Motor Graders
- 2 Asphalt Rollers
- 1 Front End Loader
- 4 Tractors (Mowing)
- 4 Trucks

### **OKLAHOMA CITY CENTRAL GARAGE**

#### 12 Diesel Powered Units

- 1 Tractor (Wildflower seeder)
- 1 Van
- 2 Crew Cabs
- 8 Trucks

**LAWTON MAINTENANCE FACILITY**

22 Diesel Powered Units

- 1 Air Compressor
- 1 Rotary Broom
- 2 Motor Graders
- 1 Slope Mower
- 1 Asphalt roller
- 2 Front End Loaders
- 6 Tractors (Mowing)
- 8 Trucks

**WOODWARD MAINTENANCE FACILITY**

17 Diesel Powered Units

- 1 Tractor Loader Backhoe
- 1 Rotary Broom
- 1 Lane Marker
- 2 Motor Graders
- 1 Asphalt Roller
- 1 Front End Loader
- 3 Tractors (Mowing)
- 7 Trucks

## Oregon

1. What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?

The original drivers for using biodiesel was the desire to help clean the environment and reduce dependence on foreign petroleum. Subsequently the Governor published his energy action plan which set goals for the use of biodiesel by state government fleets. I am attaching a link to the Oregon Energy Action Plan for your review. <http://egov.oregon.gov/ENERGY/RENEW/docs/FinalREAP.pdf>

There are also several bill being introduced in the Oregon legislature that will encourage the production of biodiesel, if they are passed.

2. Where do you use the biodiesel - what are the fleets run?

Most of our biodiesel use is in the larger population areas of Western Oregon, these are the areas where biodiesel is readily available. There are a limited number of retail outlets that sell biodiesel so we have been purchasing and distributing it from our own bulk storage tanks, we expect the availability to increase at retail outlets in the future. We use the biodiesel in all our diesel equipment that operate in the areas where it is available. This can include everything from diesel pickups to off road vehicles.

3. Do you procure the biodiesel from a single source or multiple sources?

Biodiesel is purchased off a statewide contract that is developed by the Department of Administrative Services. These are regional contracts so there can be multiple suppliers.

4. Did you have to go through a process of RFQ for purchasing the biodiesel?

Our fuel contracts are treated like other goods and trades contracts which do not require an RFQ.

5. Are your suppliers BQ9000 certified?

Yes

6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Yes, that is one of the requirements in the contract.

7. Have you had any issues with the quality at any time?

There have been no quality issues that could be attributed to the biodiesel. We had one storage tank develop bacteria growth, but since the same supplier was delivering to other ODOT tanks in the same area which didn't develop the same problem, it was determined that the biodiesel did not cause the problem.

8. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

Oregon is basically divided into two temperate zones that are separated by the Cascade mountain range which runs North and South through the state. Temperatures West of the Cascade mountains are normally mild with limited freezing temperatures in the winter. This area also includes the large population areas where biodiesel use can have the greatest impact.

We have been using it year round in these areas.

Temperatures in the zone East of the Cascade mountains can be subzero in the winter, so there has been a reluctance to use biodiesel. ODOT is still studying the possibility of its use in these areas.

9. Is your fuel choice different in winter?

See question number 8. All of our diesel is treated for cold weather in the winter.

10. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?  
We have not investigated or collected data on the fuel efficiency of biodiesel, but we have not had any complaints from our operators.

JAYNE Joe G  
Joe.G.JAYNE@odot.state.or.us  
503-986-2744

1. Is there any legislative requirement/mandate for Biodiesel in your state?

Yes, Oregon has a Renewable Energy Action Plan, developed by the Oregon Department of Energy that requires all state vehicles to use 100% B20 Biodiesel by 2025, along with shorter term goals.  
<http://egov.oregon.gov/ENERGY/RENEW/docs/FinalREAP.pdf>

2. Where do you use the biodiesel – what are the fleets run?

ODOT began using B20 Biodiesel in the states high population areas which are around Portland and Salem, we are now expanding the usage to outlying areas.

3. How do you procure the biodiesel?

It is purchased under a statewide fuel contract.

4. Are your suppliers BQ9000 certified?

That is one of the requirements of bidding on the contract.

5. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Complying with ASTM D6751 is one of the requirements.

6. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

ODOT has been using biodiesel during the winter in the temperate areas of the state. Oregon has two thirds of the state that experiences very low winter temperatures and we have been careful of expanding use to these areas. The plan is to use biodiesel in these areas in the summer and test the feasibility of it's use in the winter.

7. Is your fuel choice different in winter? What special precautions do you take in winter?

Fuel is winterized by mixing with either Number 1 diesel or chemicals.

8. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

ODOT does not have the infrastructure to accurately measure fuel efficiency although there have not been any fuel efficiency complaints from operators.

9. Have you established any specific tank maintenance program for biodiesel?

No.

10. Are the storage tanks underground? With heaters?

All of ODOT's storage tanks are above ground and do not have heaters.

11. Any modifications to the fuel system of the vehicles?

None.

12. How do you ensure effective blending?

ODOT requires the fuel to be blended before delivery, in most cases it is splash blended in the delivery truck.

13. Any issues with biodiesel storage stability?

None.

14. What have been the primary issues that Minnesota faced with the biodiesel usage and how were these overcome?

ODOT originally had problems with the supply of biodiesel but it is now readily available. The cost is higher than regular diesel so you have to be prepared to increase the fuel budget. Expect some initial problems with plugged fuel filters.

15. In your opinion, what are the best practices for implementing a biodiesel program?

ODOT's transition to B20 Biodiesel has been relatively smooth and seamless. If your fuel program is not having problems presently, switching to biodiesel should not have any negative impact other than having to prematurely change some fuel filters.

**Gregory Brown A**

Salem

## Pennsylvania

In response to your inquiry, I offer the following response. Currently the Pennsylvania Department of Transportation (PennDOT) does not have a mandated bio-diesel policy. PennDot completed a bio-diesel pilot three years ago using B-20 and had mixed results. One major problem, the trucks in the pilot study could not meet the 2004 EPA regulations.

PennDOT is planning on trying the B-5 fuel product, but we are waiting for a bio-diesel policy from the Governor's Energy Office.

Thank you very much for your inquiry and if you have any additional questions please feel free to contact the Bureau of Maintenance and Operations, Equipment Division, Nickolas Fazio at 717-787-9690 or e-mail [nfazio@state.pa.us](mailto:nfazio@state.pa.us) or William Fenkner at 717-783-4812 or e-mail [wfenkner@state.pa.us](mailto:wfenkner@state.pa.us).

**Lawrence H. Allen,**  
Acting Chief  
Equipment Division

## **Rhode Island**

The RIDOT does not have a Biodiesel Program. We also checked and the State does not have any program in place either. Good luck in your research.

**Edmund Parker**

## South Carolina

1. What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?  
SC actually does not have a biodiesel program per say. We have had some grant money to install biodiesel pumps but there is no requirement that state fleets run on biodiesel.
2. Where do you use the biodiesel – what are the fleets run?  
We have several pumps set up at state fleet management locations around the state which make B20 available.
3. Do you procure the biodiesel from a single source or multiple sources?  
I am not sure.
4. Did you have to go through a process of RFQ for purchasing the biodiesel?  
I am not sure.
5. Are your suppliers BQ9000 certified?  
Not that I am aware of.
6. How do you ensure the quality? Do you insist on ASTM D6751 compliance?  
Yes, we do require ASTM D6751 compliance.
7. Have you had any issues with the quality at any time?  
The state has not had an issue yet with the exception of some tests they ran on state-owned school buses that apparently caused some problems due to a bad batch of biodiesel.
8. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?  
Since we do not have cold winters down in South Carolina there have been no issues that I am aware of due to cold weather. I believe we use smaller blends than B20 in the winter time though according to ASTM standards.
9. Is your fuel choice different in winter?  
See above.
10. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?  
Not that I am aware of.

My capacity at the energy office is to primarily monitor public usage of biodiesel not necessarily government. I don't know as if anyone in the state government would be helpful in answering these questions since there are no requirements to use biodiesel – we just offer it as an option.

### **Erika Hartwig**

Renewable Energy Coordinator  
South Carolina Energy Office  
1201 Main Street, Suite 430  
Columbia, SC 29201  
803.737.7951 (office)  
803.737.9846 (fax)  
1.800.851.8899 (toll free)

[ehartwig@energy.sc.gov](mailto:ehartwig@energy.sc.gov)  
[www.energy.sc.gov](http://www.energy.sc.gov)  
[www.palmettocleanfuels.org](http://www.palmettocleanfuels.org)  
[www.scbiomass.org](http://www.scbiomass.org)

16. Is there any legislative requirement/mandate for Biodiesel in your state?

The SC General Assembly just passed legislation that will require at least a B5 in all state owned diesel tanks. This means that SC state fleet diesel vehicles will use at least B5 when fueling at state facilities. There is not a mandate for fuel blends at public stations.

17. Where do you use the biodiesel – what are the fleets run?

Not sure what you are asking. Mostly, in state fleet, the diesel vehicles are heavy duty. On-road and off-road. The SC DOT has the largest number of HD diesel vehicles.

18. How do you procure the biodiesel?

SC State Fleet procures biodiesel through a competitive bid process. Periodically, fuel contracts are put out for bid. Local governments can purchase off state contract or they can seek their own supplier.

19. Are your suppliers BQ9000 certified?

Not sure about this. I will check the specs.

20. How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Yes, this requirement was in the bid specification.

21. Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

Historically, SC state fleet has not used biodiesel year round, but recently passed legislation will require at least a B5 blend. I am not aware of any winter issues, but Jeff McCormack would be your best contact on this.

22. Is your fuel choice different in winter? What special precautions do you take in winter?

Again, state fleet manager would be the best responder on this.

23. Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

I have not

24. Have you established any specific tank maintenance program for biodiesel?

Yes, this was included in the state bid specs. Tank cleaning prior to switching to biodiesel. The state already has a fuel management plan in place.

25. Are the storage tanks underground? With heaters?

I can't answer this 100%, Jeff McCormack would be the best contact. I believe they are a combination of above ground and underground. I am not aware of heaters on any system.

26. Any modifications to the fuel system of the vehicles?

Just filter changes.

27. How do you ensure effective blending?

Handled in bid specs.

28. Any issues with biodiesel storage stability?

Not that I am aware of. Most fuel is turned over quickly so this would not be an issue. Several years ago, there was an issue in SC where a fleet had HD vehicles with large tanks that did very low mileage. There was an problem with stability.

29. What have been the primary issues that South Carolina faced with the biodiesel usage and how were these overcome?

Supply has been an issue as well as price. In-state production has helped this situation. General Assembly passed generous legislative incentives package for production.

15. In your opinion, what are the best practices for implementing a biodiesel program?

Ensure that you start with a clean tank and make certain you source quality biodiesel.

**Wendy Bell**

[wbell@catawbacog.org](mailto:wbell@catawbacog.org)

Catawba Regional Council of Governments

P. O. Box 450

Rock Hill, S. C. 29731

**South Dakota**

[What have been the 3 most prominent issues and how did you overcome those?](#)

Our major concerns were the cloud point of the fuel and the solvent effect it may have on our equipment. We studied a 5% blend during winter operations, our equipment did not experience gelling problems with that blend. Our sites have underground storage which helped the cloud point issue versus above ground. Some of our concerns are listed below.

- Filter plugging due to the solvent effect of biodiesel. We did not experience this, but did increase our filter inventory just in case.
- Tank cleaning program established. We were concerned that the solvent effect of the biodiesel would clean the tanks out and put the sludge in the trucks.
- Concerned about winter operations and filter plugging due to lower temperatures. We have run a 2% blend all winter in our Mitchell Region with no problems related to the fuel. Temperatures at times were as low as -20 to -30 degrees.

In closing we feel very comfortable using a 2% to 5% blend. We do however feel that would be different if we were using a blend greater than that. Another feature to the biodiesel is the increased lubricity that it provides with the ULSD fuels we are using today. Hope this helps.

[Can you elaborate on the Tank Cleaning Program that you mentioned in your email? How often do you have to schedule the maintenance?](#)

This is our first attempt at this. We have entered into contract with a company to test our diesel tanks, clean if necessary, sample and record sculpture % and cloud point on an annual basis. I have been told that retailers might clean their tanks every quarter. Our vendor is using a product called a Tank Snake to clean the tanks.

[I understand the filter plugging due to the solvent effect, but, have there been any issues due to the quality \(or the lack of it\) of the biodiesel being used in the vehicle?](#)

We have not had an issue with the quality of the biodiesel ourselves but others in the area have. Our contract specifies that the fuel must meet ASTM 6751 and BQ-9000 set up by the National Biodiesel Board. The industry has had some problems with quality (Minnesota winter of 2005-2006) and they know they need to get a handle on this if they are going to have a viable product. You do not want out of spec or improperly blended biodiesel. We do not have a testing program; we do require our vendors to meet the spec.

[Also, I gather that you have underground storage now. Was this needed due to problems with above ground storage or this was how it was designed to begin with?](#)

Our fuel sites were designed with underground facilities. We did use one above ground tanks at our sites for the study to see if we would have problems if we had to add tanks to supply the biodiesel.

[Have there been any attempts to run the vehicles on B20?](#)

Not at this time. We feel we could run the blend during the summer only. With our cold climate I feel 20% would be problematic during winter operations and that we would have to retrofit our equipment with fuel heaters etc. Most of our suppliers are unable to blend the fuel in cold temperatures so we have used very little biodiesel this winter.

[Tank Maintenance:](#)

We wanted to make sure our tanks were clean, bacteria free and that we had a record of the sulfur content. Our agreement called for an average of \$800.00 to visit each site, pull a sample and send it to a lab for analysis. If a tank required cleaning we agreed to an additional charge of \$800.00 per

tank. The tanks in the Mitchell and Aberdeen Regions were cleaned the previous year. Pierre and Rapid City had not been cleaned in a number of years. Our vendor used a process called a Tank Snake which seemed to work well. You do have an issue to dispose of some sludge that can be disposed of similar to shop waste depending on state law. Our biodiesel study showed that we needed to adopt a tank maintenance program even if we did not use biodiesel. We were fortunate to not have had much trouble with diesel but could have considering our lack of having an ongoing program. Let me know if you have any other questions.

<http://petro.odayequipment.com/tankcleaning.shtml>

**Brian J. Moore**

Internal Services Program Manager

Becker Hansen Building

700 East Broadway Ave.

Pierre, SD 57501

Desk: 605-773-3582

Cell: 605-280-1454

Fax: 605-773-2804

[brian.moore@state.sd.us](mailto:brian.moore@state.sd.us)

## Tennessee

Tennessee does not have a statute requiring biodiesel use, but Governor Bredesen issued an Executive Order in February 2006 directing state agencies to use biofuels whenever reasonably possible. The Tennessee Department of Transportation (TDOT) is phasing in the use of a B20 biodiesel blend at our major regional and district facilities across the state.

TDOT began with a pilot program in East Tennessee in December 2005. TDOT began using B20 in about 120 TDOT on road vehicles in Knoxville and Johnson City. The pilot was judged to be a success, and TDOT has begun using B20 in diesel vehicles in Chattanooga and Cookeville. The agency plans to extend B20 use to Nashville, Jackson and Memphis within the next 60 days.

For more information, please contact Ms. Linda Tidwell at [linda.tidwell@state.tn.us](mailto:linda.tidwell@state.tn.us).

### **Alan Jones**

TDOT Environmental Division

## Texas

The Texas Department of Transportation (TxDOT) does not have a similar program (requirement) as the Missouri Department of Transportation (MoDOT).

We are beginning to use biodiesel, albeit on a very small scale.

**Don Lewis**  
Fleet Manager  
TxDOT, Austin

## Utah

The State of Utah does not have any requirements for the use of Bio-Diesel we are looking at some limited use in the future.

### **Steven McCarthy**

Equipment Operations Manager

(Cell Phone) 801-580-0055

(Office Phone) 801-965-4122

(Fax) 801-965-4021

(E-Mail) [smccarthy@utah.gov](mailto:smccarthy@utah.gov)

## Washington

Washington State agencies are directed by Executive Order 05-01 to replace standard diesel with 20% biodiesel blend by September 1, 2009. Since May 2005, WSDOT has converted 27 of its 131 fuel sites statewide to 5% biodiesel. Additional fuel sites will be converted as biodiesel supplies become available. WSDOT plans to increase to B20 this spring at fuel sites currently with access to supply. WSDOT fuel sites can be used by state agencies, higher education, local government entities, school districts and some non-profit organizations throughout Washington.

Washington State Department of Agriculture has been tasked with developing quality and labeling rules for biodiesel in Washington State that are consistent with existing national standards.

Where do you use the biodiesel – what are the fleets run?

Currently, due to biodiesel availability, the 27 fuel sites with biodiesel are located in Western Washington.

Do you procure the biodiesel from a single source or multiple sources?

WSDOT purchases biodiesel off a [state contract](#)

Did you have to go through a process of RFQ for purchasing the biodiesel?

The Washington State Department of General Administrations develops and administers state contracts.

Are your suppliers BQ9000 certified?

Refer to the [state contract](#)

How do you ensure the quality? Do you insist on ASTM D6751 compliance?

Refer to the [state contract](#) Washington State Department of Agriculture has been tasked with developing quality and labeling rules for biodiesel in Washington State that are consistent with existing national standards.

Have you had any issues with the quality at any time?

WSDOT has not experienced any problems using B5 - with the fuel or with the equipment.

Do you use the biodiesel all year round in your fleets? Have there been any issues in winter?

Yes, WSDOT does use biodiesel year round. During winter 2006, delivery of biodiesel was suspended during abnormally cold weather for Western Washington because vendor was experiencing difficulties in filtering the bio product. WSDOT did not experience problems with storage or use of the biodiesel in the tanks at the time.

Have you investigated the fuel efficiency of biodiesel? Have you collected data pertaining to this?

No, WSDOT has not collected data pertaining to fuel efficiency of biodiesel.

### **Georgina Willner**

Washington State Department of Transportation

Maintenance & Operations, TEF Office

Ph: 360-705-7883

Thank you for your email. I assume Georgina answered your questions from a Department of Transportation point of view. I'll address only those questions that apply to the work of Weights and Measures in Washington. In our continuing effort to address fuel quality issues, WSDA established the Biofuels Technical Work Group comprised of industry, fleet operators, agencies, and consumer groups. Through this group we hope to achieve reasonable and rigorous enforcement of biofuel quality issues in the state. In addition, the program requested funding to expand its motor fuel quality work to encompass new biofuels entering the marketplace.

[What was the requirement for the biodiesel program in your case? Was there any legislature requirement? If yes, then what was it?](#)

In 2006, the Washington State legislature passed a Renewable Fuel Standard describing the following:

- Certain special fuel licensees must provide evidence to the Department of Licensing (DOL) that at least 2 percent of total annual diesel fuel sales are biodiesel fuel sales, whenever the earlier of two events occur: (1) The Director of the DOA determines that feedstock grown in Washington can satisfy the 2 percent requirement; or (2) on November 30, 2008. The reporting level rises to 5 percent biodiesel sales when the Director of DOA determines that both in-state oil seed crushing capacity and feedstock grown in Washington can satisfy 3 percent of total annual diesel fuel sales.
- Beginning December 1, 2008, certain motor vehicle fuel licensees must provide evidence that at least 2 percent of all gasoline sold in Washington is denatured ethanol. All gasoline sold in Washington must contain higher percentages of denatured ethanol if the Director of the Department of Ecology (DOE) determines that ethanol content greater than 2 percent will not jeopardize continued attainment of federal Clean Air Act standards, and the Director of DOA determines that sufficient raw materials are available within Washington to support economical production of ethanol at higher levels.

In addition, the Governor's Executive Order 05-01 requires state agencies to use a 20 percent biodiesel blend by September 1, 2009, and encourages agencies to use a 5 percent blend as soon as practicable.

[Are your suppliers BQ9000 certified?](#)

The Weights and Measures program does not expect to place any requirements on producers or suppliers in the state. The program will test fuel for quality, but will not mandate how that quality is achieved. Likely, many fuel purchasers will require quality programs in contracts.

[How do you ensure the quality? Do you insist on ASTM D6751 compliance?](#)

The Weights and Measures program expects to adopt D6751 as an enforceable standard for B100 fuel quality in the next few weeks. Once that standard is in place, the program will sample fuel throughout the production/distribution chain to assess quality. The program will emphasize sampling of fuel blendstocks prior to blending, but will also sample blend percentages at the pump. If/when ASTM adopts standards for biodiesel blends, it is expected that Weights and Measures will adopt and administer those standards.

[Have you had any issues with the quality at any time?](#)

Quality problems have occurred in the state, based on various fleet reports and reports from suppliers who have turned away poor quality imported fuel.

Regards,

**Jeff Canaan**

Biofuels Standards Coordinator  
Weights and Measures  
Washington State Department of Agriculture  
P.O. Box 42560  
Olympia, WA 98504-2560  
(360) 902-2035  
[jcanaan@agr.wa.gov](mailto:jcanaan@agr.wa.gov)

## **West Virginia**

The WVDOT does not have any requirement for utilization of Biodiesel. Thank you

**John Walker**

## **Wyoming**

Wyoming has no bio-diesel program.

**Dale Hoffman**

**APPENDIX C: SURVEY FORM**

Alternative	Left-hand side alternative is			Both have equal importance	Right-hand side alternative is			Alternative
	significantly	moderately	slightly		slightly	moderately	significantly	
	more important than right-hand side.				more important than left-hand side.			
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	B (BQ9000)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	C (ASTM)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	D (Tank)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	E (Underground)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	F (Heat Storage)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	G (Filters)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	H (H <sub>2</sub> O Trap)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I (Pre-blend)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J (Additives)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K (Heat System)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	L (Biocides)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	M (Full Tanks)
A (Vary % )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N (Compatibility)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	C (ASTM)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	D (Tank)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	E (Underground)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	F (Heat Storage)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	G (Filters)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	H (H <sub>2</sub> O Trap)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I (Pre-blend)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J (Additives)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K (Heat System)
B (BQ9000)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	L (Biocides)
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C (ASTM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N (Compatibility)
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D (Tank)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	L (Biocides)
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D (Tank)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N (Compatibility)
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E (Underground)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	L (Biocides)
E (Underground)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	M (Full Tanks)

E (Underground)	<input type="checkbox"/>	N (Compatibility)							
F (Heat Storage)	<input type="checkbox"/>	G (Filters)							
F (Heat Storage)	<input type="checkbox"/>	H (H <sub>2</sub> O Trap)							
F (Heat Storage)	<input type="checkbox"/>	I (Pre-blend)							
F (Heat Storage)	<input type="checkbox"/>	J (Additives)							
F (Heat Storage)	<input type="checkbox"/>	K (Heat System)							
F (Heat Storage)	<input type="checkbox"/>	L (Biocides)							
F (Heat Storage)	<input type="checkbox"/>	M (Full Tanks)							
F (Heat Storage)	<input type="checkbox"/>	N (Compatibility)							
G (Filters)	<input type="checkbox"/>	H (H <sub>2</sub> O Trap)							
G (Filters)	<input type="checkbox"/>	I (Pre-blend)							
G (Filters)	<input type="checkbox"/>	J (Additives)							
G (Filters)	<input type="checkbox"/>	K (Heat System)							
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G (Filters)	<input type="checkbox"/>	M (Full Tanks)							
G (Filters)	<input type="checkbox"/>	N (Compatibility)							
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H (H <sub>2</sub> O Trap)	<input type="checkbox"/>	N (Compatibility)							
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I (Pre-blend)	<input type="checkbox"/>	K (Heat System)							
I (Pre-blend)	<input type="checkbox"/>	L (Biocides)							
I (Pre-blend)	<input type="checkbox"/>	M (Full Tanks)							
I (Pre-blend)	<input type="checkbox"/>	N (Compatibility)							
J (Additives)	<input type="checkbox"/>	K (Heat System)							
J (Additives)	<input type="checkbox"/>	L (Biocides)							
J (Additives)	<input type="checkbox"/>	M (Full Tanks)							
J (Additives)	<input type="checkbox"/>	N (Compatibility)							
K (Heat System)	<input type="checkbox"/>	L (Biocides)							
K (Heat System)	<input type="checkbox"/>	M (Full Tanks)							
K (Heat System)	<input type="checkbox"/>	N (Compatibility)							
L (Biocides)	<input type="checkbox"/>	M (Full Tanks)							
L (Biocides)	<input type="checkbox"/>	N (Compatibility)							
M(Full Tanks)	<input type="checkbox"/>	N (Compatibility)							
Suggestion 1:  (Please specify on cover sheet.)	<input type="checkbox"/>	A (Vary % )							
	<input type="checkbox"/>	B (BQ9000)							
	<input type="checkbox"/>	C (ASTM)							
	<input type="checkbox"/>	D (Tank)							
	<input type="checkbox"/>	E(Underground)							
	<input type="checkbox"/>	F (Heat Storage)							
	<input type="checkbox"/>	G (Filters)							
	<input type="checkbox"/>	H (H <sub>2</sub> O Trap)							
	<input type="checkbox"/>	I (Pre-blend)							
	<input type="checkbox"/>	J (Additives)							
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	K (Heat system)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	L (Biocides)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	M (Full Tanks)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N (Compatibility)	



Missouri Department of Transportation  
Organizational Results  
P. O. Box 270  
Jefferson City, MO 65102

573.526.4335  
1 888 ASK MODOT  
[innovation@modot.mo.gov](mailto:innovation@modot.mo.gov)