

FINAL PROGRAM REPORT

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National Biodiesel Board



National Biodiesel Infrastructure Development Initiative

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DOE PMC Project Monitor

Evan Mueller

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September 30, 2006 – December 31, 2011

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DOE - \$1,240,000
NBB - \$550,890
TOTAL - \$1,790,890

Acronyms

AFPM	American Fuel and Petrochemical Manufacturers (see NPRA)
ALAMN	American Lung Association of Minnesota
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BEN	Biodiesel Education Network
CONEG	Coalition of Northeastern Governors
DOE	Department of Energy
EI-JIP	Energy Institutes Joint Industry Project
EISA	Energy Independence and Security Act
JIG	Joint Information Group
MBC	Minnesota Biodiesel Council
MPMA	Minnesota Petroleum Marketers Association
MPP	Multi-Product Pipeline system
MSR & PC	Minnesota Soybean Research and Promotion Council
MTA	Minnesota Trucking Association
NBB	National Biodiesel Board
NPRA	National Petrochemical and Refiners Association (see AFPM)
NREL	National Renewable Energy Laboratory
PBSC	Pipeliner Biodiesel Steering Committee
PHMSA	Pipeline and Hazardous Materials Safety Administration
PMAA	Petroleum Marketers Association of America
RFS	Renewable Fuel Standard
ULSD	Ultra Low Sulfur Diesel
USPS	United States Postal Service

National Biodiesel Infrastructure Development Initiative – Final Report

Executive Summary

In September 2006, the National Biodiesel Board (NBB) received funding from the US Department of Energy (DOE) for the National Biodiesel Infrastructure Development Initiative. The goal of this project was to increase acceptance of biodiesel among domestic fuel distributors and suppliers and address technical barriers and needs to facilitate movement of low-level blends of biodiesel in large pipelines in the US. To meet this goal multiple fuel tests and demonstrations were conducted. Industry outreach and education for upstream and downstream users was also implemented with a focus on the state of Minnesota. The initiative was renewed in October 2007 and extended through the end of December 2011.

In year one, NBB executed a petroleum pipeline test run. Fuel test results confirmed that a 5% blend of biodiesel could be successfully moved from Houston, Texas to Linden, New Jersey while maintaining D975 specifications. Uncertainty about the legal status of the Renewable Fuel Standard (RFS) and the federal tax incentive yielded unfamiliar market conditions for additional pipeline trials with jet fuel under this project. However, the NBB formed the Pipeliner Biodiesel Steering Committee with the five major independent pipeline companies (Buckeye Partners, Colonial Pipeline, Explorer, Magellan Midstream Partners and Teppco) that identified the remaining barriers to pipeline shipments and began to execute those needs using other funding sources.

Later in the project a lubricity study conducted by NBB partners concluded that replacing lubricity additives with biodiesel could be a cost-effective and an environmentally responsible way to achieve lubricity in ultra-low sulfur diesel fuels. A United States Postal Service Fleet Evaluation led by the National Renewable Energy Laboratory aimed to achieve better understanding of biodiesel's effect on engine oil and wear. The demonstration found there were no significant issues or adverse conditions that could be traced to the use of biodiesel.

Improved access to biodiesel by marketers and end-users was addressed through infrastructure development and certification standards assistance. The project supported the installation of two biodiesel terminals in Kansas City and Jefferson City, Missouri. Project partners collaborated with industry experts in biodiesel and equipment certification leading to recognition by the Underwriters Laboratory of blends up to B5 for all applications using ASTM D975 on/off road diesel fuel and D396 heating oil falling under the existing listings for D975 and D396.

A multi-pronged Fuel Quality Awareness and Education Campaign was implemented with an emphasis on the state of Minnesota. Program guides were developed and fuel quality training sessions were held on NBB's BQ-9000 certification program. Working with the Minnesota Biodiesel Council and the American Lung Association of Minnesota, biodiesel literature was developed and sent to consumers and distributed at truck stops and driver workshops throughout the state. Radio spots further promoted biodiesel use. Fuel testing at state biodiesel plants resulted in improved fuel quality.

The Biodiesel Infrastructure Development Initiative was successful in providing information to the biodiesel industry and consumers and met the goal of increased confidence in and acceptance of biodiesel. As a result of this campaign, hundreds of people were educated about biodiesel. This effort provided vital training and outreach to the industry on general biodiesel education, storage, filtering, handling, and fuel quality. This project was invaluable to growing the biodiesel industry.

Based on the results and accomplishments associated with this project effort, as well as other recent industry developments, the NBB recommends that the following activities be considered in future DOE funding for biodiesel infrastructure.

1. Execute additional technical activities identified by the Pipeliner Biodiesel Steering Committee that address barriers to biodiesel blend pipeline shipments.
2. Continue to invest in upstream tanks, piping, and associated equipment to store and blend biodiesel at the bulk terminal and pipeline terminal levels. There is very little downstream infrastructure needed since the existing diesel equipment at filling stations can be used to store and dispense B20 and lower blends.
3. Facilitate additional blending of biodiesel. Consider bench or hand-held biodiesel blend level testing equipment as part of the infrastructure needed for biodiesel blends. Continue to provide funding for the purchase and installation of such equipment by both upstream and downstream entities.
4. To facilitate pipeline shipments and management and tracking of blend levels at terminals, invest in the development and prove-out of in-tank and/or in-line blend level testing equipment with flow totalizers for biodiesel.

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Introduction

In 2006, when the National Biodiesel Infrastructure Development Initiative was developed, it was anticipated that the US would increasingly rely on clean, domestic, renewable fuels. The Energy Policy Act of 2005 had provided tax incentives and loan guarantees for fuel production, and NBB's vision for the industry was for biodiesel to become an integral component of a national energy policy by 2015. Sales, primarily in the form of low-level biodiesel blends, were expected to replace 5% of diesel demand or 1.8 billion gallons. In addition to the federal fuel volume standards, energy security and environmental benefits of low-level blends were also significant and important sources of demand for biodiesel.

In September 2006, the National Biodiesel Board (NBB) received a grant from the US Department of Energy's (DOE) Office of the Biomass Program, Golden Field Office to fund the National Biodiesel Infrastructure Development Initiative. Under this grant, NBB partnered with petroleum product wholesalers to perform a pipeline run for the purpose of confirming how biodiesel behaves in the US pipeline system. Prior to this project, only limited testing had been done on biodiesel movements through pipelines in the US, and testing information was not publicly available. This project was also the first demonstration of biodiesel in a US pipeline. Demonstration results were expected to raise awareness and help dispel speculation about moving low-level blends of biodiesel on the pipe. The outreach and education component of the project was directed at petroleum marketers providing them with correct procedures for blending, shipping and storing ASTM D6751 quality biodiesel as well as steps to address potential fuel quality problems. The project also resulted in the installation of a biodiesel meter-blending terminal at each of two existing petroleum terminals.

At the beginning of year two, DOE extended the project under a continuing resolution making possible a second phase of pipeline testing and additional industry outreach. A United States Postal Service (USPS) biodiesel evaluation conducted by the National Renewable Energy Laboratory (NREL) was also added as a fourth task under the project renewal.

NBB is the national trade association representing the biodiesel industry and is the coordinating body for biodiesel research and development in the US. NBB's membership is comprised of state, national, and international feedstock and feedstock processor organizations, biodiesel producers, fuel marketers and distributors, and companies providing services to the industry such as laboratories and technology providers. NBB's mission is to advance its members' interests by creating sustainable biodiesel industry growth.

This project was completed in collaboration with: Advanced Fuels Solutions; Buckeye Partners; Magellan Midstream Partners; MARC-IV Consulting, Inc.; Meg Corp; the Minnesota Biodiesel Council; and the National Renewable Energy Laboratory.

Goals and Objectives

The goal of the National Biodiesel Infrastructure Development Initiative was to gain increased acceptance of biodiesel among domestic fuel distributors and suppliers and address barriers to movement of low-level blends of biodiesel in large pipelines in the US. With the exception of executing a secondary pipeline movement under Phase II, due to uncertain market conditions outside the control of NBB, all of the project objectives were met or exceeded. The project objectives were as follows.

Phase I (FY2007)

Upstream Petroleum Industry Education & Pipeline Runs: To demonstrate the performance of low-level blends of biodiesel in pipelines through actual trial testing and evaluation.

Infrastructure Development: To install meter-blending terminals to assure accurate biodiesel blending and distribution while reducing end-user costs.

Downstream Outreach and Education: To increase confidence and acceptance of biodiesel through a public campaign to educate terminal operators, distributors and end users on blending, ASTM standards, and the BQ-9000 biodiesel quality assurance program for petroleum marketers. Emphasis was placed on the state of Minnesota.

Phase II (FY2008 - 2011)

Pipeline Runs: To demonstrate the impact of low-level blends of biodiesel on subsequent fuel in pipelines through actual trial testing and evaluation.

Equipment Certification Entities: To address the concern that the biodiesel industry lacks certification procedures for storage and refueling equipment.

Continued Upstream and Downstream Outreach and Education: Emphasis was placed on maintaining fuel quality standards throughout the supply chain.

United States Postal Service Fleet Evaluation: To demonstrate that a B20 blend could operate satisfactorily in fleet vehicles if the fuel blend met quality, specification and stability standards.

Summary of Activities

This section provides a summary of the completed activities and milestones including the approaches used, problems encountered, and resolutions.

Task 1: Petroleum Pipeline Testing and Upstream Petroleum Industry Education

The objective of this task was to demonstrate the performance of low-level blends (5%) of biodiesel in pipelines through actual trial testing and evaluation. The task included pipeline company education through national workshops and articles in industry publications. Lubricity testing was conducted to demonstrate the performance benefits of biodiesel versus conventional fuel additives.

1.1 and 1.2 (Phase I): First Pipeline Run and Petroleum Product Merchant Identification



In the first year, NBB executed a pipeline run (*Milestones 1.1.ML2 and 1.2.1.ML1*). As a result, two additional pipeline runs were planned for a second phase. The first run tested movement of 74 grade (500 ppm highway diesel) blended with 5% biodiesel (soy-based methyl ester). NBB worked with Northville Product Services (Northville) to supply and own the biodiesel-blended product and with Colonial Pipeline (Colonial) to execute the run. The primary purpose of the test was to quantify the impact of

biodiesel on product quality through a long pipeline movement.

Fuel was sampled and placed on the pipe for movement using test protocols developed by the project partners (*Milestone 1.1.ML3*). A test batch of 75,000 barrels (bbls) was pumped by Northville from Kinder Morgan's Pasadena terminal into Colonial's 36" distillate line. The B100 (100% biodiesel) had been purchased from World Energy and brought into Kinder Morgan via barge through a common system and delivered into an unheated holding tank where it was blended with the ultra-low sulfur diesel (ULSD) fuel. The holding tank had product in it prior to the barge discharging. From the holding tank, product was brought in by pipeline. The tank was equipped with a mixer, which ran during the discharge of the barge and the inbound of the pipeline to ensure thorough mixing of the biodiesel and highway diesel. Upon completion of the inbounds, the tank was sampled at different height levels by technicians and subsequently analyzed for proper mixing. The end results confirmed that a 5% blend of biodiesel could be moved successfully from Houston, TX to Linden, NJ while maintaining ASTM D975 specifications. NBB and its partners considered this test a success for demonstrating the viability of biodiesel on future pipeline runs. There were no adverse impacts to the base fuel specification of the blended B5 batch, and all

ASTM D975 specifications were acceptable including no traces of water or sediment (*Deliverable 1.1.DL1*).

The demonstration did, however, generate uncertainty regarding methyl-ester transmix that needed to be addressed before low level blends of biodiesel could be used routinely on pipelines. Based on the feedback from Colonial, test methods were not available to determine trail back below 1.7% by volume. Northville and Colonial both wanted a test method developed with accuracy to single digit parts per million of methyl ester. Subsequently, a test method was developed in Europe for determination of single digit ppm level biodiesel in jet fuel. This recommendation resulted in the development of the second phase of this project.

1.1 and 1.2 (Phase II): 2nd and 3rd Pipeline Runs and Petroleum Product Merchant Identification

Following the successful completion of the first pipeline run, discussions began in early 2007 with Buckeye Partners, LP (Buckeye) to complete a second run. At the time, Buckeye was interested in moving 5% biodiesel from Indiana to Lima, Ohio and possibly to Toledo. These discussions continued into the summer of 2007 when it was decided that Buckeye would proceed independently and would share data for a Midwest run. Discussions were also held with Magellan about doing another pipeline run.

Concurrently, there were several major developments in the fuel industry that influenced NBB's approach to an additional pipeline run. These developments led NBB to focus attention on ASTM, test protocols and approval of biodiesel as a jet fuel.

Approval of 5% biodiesel as a fungible component with on/off road diesel and home heating oil.

In October 2008, ASTM International released the first-ever approved ASTM specifications for finished blends of biodiesel and petro-diesel. The specifications for conventional petro-diesel for on/off road fuel use (ASTM D975) and for home heating oil use (ASTM D396) were modified to include up to 5% biodiesel meeting an updated version of the B100 blend stock specification (ASTM D6751). ASTM also approved ASTM D7467 for on/off road use in blends over 5% biodiesel and including up to 20% biodiesel (B6-B20). This accomplishment allowed the industry to overcome a significant barrier to biodiesel blends acceptance.

Development of pipeline run test protocols and other technical needs to support biodiesel blend shipment in US pipelines

As this DOE project progressed, the five major pipeline companies and the National Biodiesel Board formed the Pipeliner Biodiesel Steering Committee (PBSC)¹. The PBSC

¹ The Pipeliner Biodiesel Steering Committee (PBSC) was formed to address technical and regulatory issues associated with the transport of biodiesel through the US Multi-Product Pipeline (MPP) system. Committee members are the National Biodiesel Board and 5 major US pipeline companies – Buckeye Partners, Ltd., Colonial Pipeline, Explorer, Magellan Midstream Partners, and TEPPCO.

worked closely with the Pipeline and Hazardous Materials Safety Administration (PHMSA) to encourage biodiesel projects within PHMSA and to develop detailed collection protocols for data supplied to pipeline companies making internal business decisions on commercial shipments of biodiesel on pipelines. The PBSC recommended that all future pipeline runs provide the data as identified in the PBSC protocols. The PBSC developed a comprehensive list of technical activities needed to facilitate pipeline shipments which consisted of 33 separate questions and research topics. The PBSC began to execute projects addressing these needs with funding from sources outside this DOE project.

Although the need for continued pipeline runs remains important, the PBSC identified the extremely low levels of biodiesel allowed in jet fuel, as defined by jet aircraft aviation OEMs, as being the single greatest barrier to pipeline shipments of biodiesel.

Approval for 100 ppm biodiesel allowance in jet fuel

The third major development was an effort led by the Energy Institute in the United Kingdom (UK) called the Energy Institute Joint Industry Project (EI-JIP). This project worked on gaining OEM approval of up to 100 ppm biodiesel in aviation turbine fuel. The PBSC became aware of the EI-JIP only after they had developed their list of 33 needs (discussed above) in 2008 at ASTM. During this period, the biodiesel requirements stipulated in the Energy Independence and Security Act (EISA) of 2007 were also a major driver in moving biodiesel on multi-product pipelines. The EISA required the annual sale of 500 million gallons of biodiesel in 2009 and up to one billion gallons by 2012.

The EI-JIP effort received approximately half their funding from the government and the other half from industry sources with participation by most of the major oil companies in the US and Europe (i.e. BP, Shell, ExxonMobil, Chevron, Total, etc.), the UK and US militaries, all the major airframe and engine OEM's (i.e. Airbus, Boeing, Bombardier, Cessna, Embraer, GE, Honeywell, Pratt & Whitney, Rolls Royce, etc.), and the European and US regulatory agencies (i.e. Federal Aviation Administration, UK Defense Standards, etc.). The PSBC also became a paying participant through other funding provided by the National Biodiesel Board. The total project costs were estimated at over \$2,100,000. While spearheaded by the Energy Institute in the UK, the effort covered pipeline shipments around the world.

The EI-JIP effort included the development of test methods to quantify the biodiesel levels in jet fuel at the single digit ppm and the 30-100 ppm levels. These results were used by the EI-JIP to quantify the term 'non-detectable', the only level deemed acceptable by the airframe and engine OEM's. It was determined the lower detection level of the best test method available at the time (gas chromatography mass spectrophotometry, GC-MS), 5 parts per million (ppm) was acceptable. This value, 5 ppm maximum, was subsequently balloted into US jet fuel specifications (ASTM D1655) and European jet fuel specifications (Def Stan 91-91). While B5 shipments successfully occurred on European pipelines and the levels of biodiesel in jet fuel were kept below 5 ppm, it was extremely time consuming and expensive to do so. US pipelines determined the 5 ppm level was too low to be

commercially viable for larger, more fungible US pipelines and all US pipelines currently prohibit movement of biodiesel in jet fuel lines because of this concern.

With test methods in hand and an agreement between Europe and US interests that a level higher than 5 ppm was needed, the EI-JIP proceeded to execute the significant testing needed to secure 100 ppm biodiesel approval in jet fuel. This level would be sufficient to ease the burden on European pipelines and still be high enough to make commercial applications in the US more feasible, although additional effort would still be needed to secure biodiesel blend approvals in US pipelines. Testing efforts followed those needed to approve commercial additives in jet fuel using the protocols and testing outlined in the ASTM D4054 Standard Practice. D4054 requires testing with four times the desired approval level, so 400 ppm biodiesel was tested in order to secure approval for 100 ppm biodiesel in jet fuel.

As efforts to approve 100 ppm biodiesel in jet fuel advanced, work continued on executing the project's second and third pipeline runs. In June 2009, the PBSC developed and sanctioned new test protocols that would provide all the data needed by US pipelines to evaluate commercial shipments of biodiesel blends. At this point NBB was in discussion with Magellan Midstream Partners (Magellan) and Buckeye Partners, LP (Buckeye) to complete the final two runs. Magellan and Buckeye began preparing for the run by evaluating their product schedules and working with fuel owners to determine run details (preceding product, post product, total barrels of B5, and shipment locations). Both companies worked on securing commercial partners to transport fuels on their pipelines. However it proved difficult to match demand in locations served by Magellan and Buckeye with product sequencing for testing purposes. Further, the absence of the RFS2 ruling led to reduced biodiesel volumes and neither company was able to identify commercial partners.

In the fall of 2009, Magellan was feeling the full impact of the absence of a final RFS2 ruling on biodiesel production. They indicated they would be unable to make commercial arrangements with position holders for biodiesel blend pipeline runs and pulled out of the project. By October, Buckeye was indicating similar concerns. At the December PBSC meeting, the other PBSC member pipeline companies, Explorer, Colonial, and Teppco, all shared the same sentiment. Without the release of the RFS2 and an extension of the biodiesel tax credit, potential pipeline partners were unwilling to commit to the project, even though they all were interested in its outcome.

By early 2010, NBB began exploring the option of requesting a project re-scope that would eliminate the second and third pipeline runs and replace them with additional industry outreach and education. DOE's preference, however, was for NBB to continue to pursue the pipeline runs.

During this same period, EPA released the final RFS2 ruling confirming biodiesel as the only advanced biofuel made in commercial volumes in the US. The RFS2 ruling was followed by the launch of a lawsuit filed by the American Petroleum Institute (API) and the National

Petrochemical & Refiners Association (NPRA)² against the EPA for the late issuance of the rules and which requested a one-year delay in implementation. The lack of the tax incentive and the impending API/NPRA law suit resulted in further decreases in biodiesel production making it virtually impossible to identify a willing pipeline partner.

It became apparent by summer 2010 that NBB would not be able to complete a pipeline run before March 2011. With decreasing biodiesel production and sales, the industry was not in an immediate position to provide the pipeline industry with sufficient demand to conduct the type of run needed, i.e. jet fuel or #1 diesel fuel followed by a B5 blend. With the 2011 RFS2 requirements for biomass based diesel fuel expecting to approach 850 million gallons, project partners expected a potential pipeline run in the spring of 2011.

While several iterations of the materials testing were needed, which further delayed the project substantially, by mid-2011, most of the needed data was attained pointing to positive approval of 100 ppm biodiesel in jet fuel. Only one result, using a seldom used thermal stability test rig developed and operated by Rolls Royce Aviation showed the potential for slightly increased maintenance over a 20,000 hour aircraft engine lifespan. Part of this test was repeated without adverse impacts, but as of the writing of this report the original results have not yet been explained to the satisfaction of Rolls Royce and they refuse to sign off on the 100 ppm biodiesel without further testing. This testing is scheduled to occur during the summer of 2012. If successful, then the approval of 100 ppm biodiesel can move forward.

As projected, by late winter 2011, biodiesel volumes increased In March and two companies verbally expressed interest in partnering on the project with shipment targets set for fall 2011. Each company worked on details for supply and off-take. This was critical because a willing biodiesel supplier and biodiesel blend purchaser were needed as project funds could not be used to defray the shipping and fuel costs. In May, a third pipeline company also expressed interest in joining the project. However, as talks progressed through the summer, it became apparent most of the proposed runs would not take place until 2012 -- exceeding the project performance period. Every effort was made to determine if run samples could be collected prior to the end of the calendar year but without success.

Incomplete Pipeline Run - Explanation of Variance

As discussed above, despite many hours spent negotiating with potential partners over a four-year period, it became clear that NBB would not be able to secure a pipeline partner within the project's parameters before the performance period ended on December 31, 2011. NBB informed DOE in late December that they would not seek an extension to complete the remaining two pipeline runs.

A number of factors outside NBB's control contributed to the inability to secure a partner to execute the second and third pipeline runs, none of which were related to a lack of interest

² NPRA changed their name in January 2012 to the American Fuel & Petrochemical Manufacturers (AFPM)

or need on the part of the fuel industry for the test runs. Even with the biodiesel market downturn, NBB was surprised to encounter such difficulty scheduling runs given the urgency for testing previously expressed by several major oil companies. It should be re-emphasized that funding under this grant covered only the analytical testing associated with a pipeline run and not the purchase, blending, and transport of a particular biodiesel blend. These costs were the responsibility of the pipeline partner. Therefore, without sufficient demand in the market, it was difficult for a partner company to justify the purchase of pipeline fuel.

Upstream Petroleum Industry Pipeline Education

Task 1 included educating pipeline companies and petroleum product merchants about test run results and other key issues related to moving biodiesel. NBB hosted a series of four webcasts for industry partners such as Colonial and Buckeye and attended six industry conferences for SIGMA, Platts, NBB, American Pipeline Organization (APO), and the Independent Liquid Terminal Association during the period October 2006 to June 2007 (*Milestones 1.1.ML1 and 1.3.ML4*). Articles were submitted to industry publications (SIGMA, Energy & Oil magazine, Oil & Gas Journal) and NBB's online Biodiesel Education Network service (Ask Ben) provided the industry with up-to-date information on issues surrounding pipeline possibilities with biodiesel.

1.3 Lubricity Testing

The purpose of the lubricity study was to determine the effects of biodiesel on ULSD #1 and #2 samples in comparison to those of conventional lubricity improving additives. The lubricity character of a fuel impacts its operability in real-world applications such as transport and heating. Early in the project, NBB established a review committee to evaluate the lubricity testing (*Milestone 1.3.ML1*). Committee members included Paul Nazzaro of Advanced Fuel Solutions, Hoon Ge of Meg Corporation, and Leland Tong of Marc-IV Consulting. Testing was done by Magellan Midstream Partners, LP. Seven different biodiesel samples of varying concentrations were blended into 11 different ULSD fuel samples randomly selected from around the country. Lubricity was measured using the High Frequency Reciprocating Rig (HFRR) method which determines the lubricity of a fuel based on wear scar. Lubricity improvement was seen in biodiesel blends as low as 0.5%. And at a 1% blend, all seven B100 samples lowered the average wear scar of the 11 ULSD samples below the recommended 520 μm .

The study concluded that replacing lubricity additives with biodiesel could be a cost-effective and environmentally responsible way to achieve lubricity in ULSD fuels. The results of the study were compiled in a February 2008 report prepared by MEG Corp, *Effects of Additives and Biodiesel from Various Feedstock on Lubricity of Ultra Low Sulfur Diesel (ULSD)* and submitted to the review team listed above (*Milestones 1.3.ML2 – ML3*). [1] The test results were posted on the NBB web site and a presentation was submitted to DOE (*Deliverable 1.3.DL1*).

Task 2: Infrastructure Development and Certification Standards Assistance

2.1 Infrastructure Development

This task addressed improved access to biodiesel by marketers and end-users. NBB's industry partner, Jefferson Biofuels LLC, installed a fully automated meter blending terminal at their Kansas City facility and completed modifications to an existing unit in Jefferson City (*Milestones 2.1.ML1 and ML2*). The site openings at both locations were promoted to the public. A summary report of the equipment installed at each site and fuel volumes dispensed over a 3-year period from October 2008 to September 2010 is in the Appendix (*Deliverable 2.2.DL1*).

The project was implemented without significant difficulty and Jefferson Biofuels considered it to be a success. The volume of fuel dispersed at each terminal fluctuated in response to changes in oil prices and seasonal demand. Farmers are the primary biodiesel consumers in the region served by the two terminals. As petroleum diesel prices dropped below that of biodiesel, sales decreased. Volumes were also subject to seasonal demand. Sales increased in late summer and decreased in the colder months.

2.2 Certification Standards Development

Between October 2009 and Sept. 2010, NBB collaborated with key industry experts in biodiesel and equipment certification to aid the Underwriters Laboratory, Inc. (UL) and other equipment certification organizations to develop protocols for evaluating B5 and B20 blends, dispensing equipment, and pipes and tanks for biodiesel distribution.

UL concerns about biodiesel were addressed through NREL testing. UL officials were favorably impressed with the depth and breadth of the ASTM review process. UL subsequently approved blends up to B5 for all applications using D975 fuel (on/off road diesel) and D396 (heating oil) beginning in 2010. This major success was a direct result of project activities.

In the spring of 2008, the California Water Board had prohibited underground storage of biodiesel blends in California contingent on EPA approval of biodiesel in detection equipment and UL listing of B20 blends and leak detection systems. MARC-IV's Steve Howell and NREL's Bob McCormick worked with members of the Water Board, EPA's National Working Group on Leak Detection Evaluations (NWGLDE), UL, Steel Tank Institute and members of the piping, dispenser and tank industry to draft protocols and acquire the data needed for approval.

In mid-2009, the California Water Board released an emergency ruling favorable to B5 and B20 use in underground tanks. Through September 2009, NBB's contractor, MARC-IV, continued to work with UL, EPA, and the California Water Board toward securing UL and other standard body approvals for B5 and B20 blends. A face to face meeting with the National Work Group on Leak Detection Evaluations (NWGLDE) occurred in late September where MARC-IV proposed a protocol for the testing and approval of B20 and lower blends and a separate protocol for B21 to B100 blends that would require minimal testing compared to that of existing diesel fuel. The NWGLDE accepted the proposal in full, and has

now approved B6 to B20 blends for leak detection that is approved for petrodiesel, with the only additional technical work needed for higher blends being that of materials compatibility. Funding for this area was expended, so further efforts were moved to other NBB funded projects.

The above summary of the work to develop certification standards completes Deliverable 2.2.DL 1.

Task 3: Fuel Quality Awareness and Education Campaign

A downstream outreach and education campaign was conducted to increase acceptance of biodiesel within the petroleum industry at the terminal and distributor levels and among end-users. The topics in the education campaign covered blending, biodiesel handling and usage of ASTM standard fuel, and the BQ-9000 quality assurance program. The project focused on outreach within the state of Minnesota although many of the activities had an impact nationwide. There were five components to this task. They are as follows:

3.1 BQ-9000 Awareness Campaign

The National Biodiesel Accreditation Program, called BQ-9000[®] is a cooperative and voluntary program open to any biodiesel manufacturer, marketer or distributor of biodiesel and biodiesel blends in the United States and Canada. The program combines the fuel standard for biodiesel, ASTM D6751 and a quality systems program that includes storage, sampling, testing, blending, shipping, distribution, and fuel management practices. Awareness of the BQ-9000 program was raised through a training sessions and guidance manuals.

3.1.1 Fuel Quality Training Sessions

A total of nine BQ9000 training sessions were held (*Milestone 3.1.ML1*) exceeding the milestone that originally called for six sessions. These intensive 6-hour courses were designed to help quality management representatives understand the program requirements and the steps involved in creating a quality system for their company. The courses were taught by BQ-9000 auditors with 20 to 25 participants in attendance at each session. During the period between October 2006 and September 2007, courses were held at sites around the country (Philadelphia, Atlanta, Kansas City, Charlotte, Seattle and Boston). Excess income generated by the seminars was used to develop fire-prevention material and other related environmental issue briefs through the BQ-9000 program.

3.1.2 Guidance Documents

In early 2008, NBB published two manuals written for the BQ-9000 program, The *BQ-9000 Marketer Program Guidebook* [2] and the *BQ-9000 Producer Program Guidebook* [3] (*Deliverable 3.1.DL.1*). These documents specified the organizational requirements needed for a quality management system and quality assurance program to: a) demonstrate its ability to receive product that meets ASTM D 6751, b) blend biodiesel and distribute it, c) comply with applicable regulatory requirements, and d) address

quality assurance through the effective application of the program, including processes for corrective action and the prevention of nonconformity. Using funds outside this grant, NBB distributed CD copies of the two manuals.

3.1.3 Producer Education and Fuel Test Survey

Early in the project, NBB was made aware that performing fuel quality testing on its own industry could have a detrimental impact on the organization. As a result, DOE approved a scope change replacing this task with a United States Postal Service (USPS) fleet evaluation in Florida. The evaluation was done in collaboration with the National Renewable Energy Laboratory (NREL). See Task 4.

3.2 Minnesota Educational Campaign

Working in partnership with Minnesota Biodiesel Council (MBC), NBB implemented a two-pronged educational campaign aimed at Minnesota biodiesel distributors and at truck and fleet. The effort included providing education information to biodiesel distributors and truckers and fuel quality testing. All milestones were met or exceeded.

3.2.1 Targeting Minnesota Biodiesel Distributors

The project provided distributors information on biodiesel and the BQ-9000 certification program. MBC worked with the American Lung Association of Minnesota (ALAMN) to conduct two programs: 1) Driving Minnesota Biodiesel, and 2) Minnesota High School Clean Air Choice Scholars Program. The program included literature distribution, advertising, educational events and fuel sampling.

Literature distribution: MBC distributed electronic copies of NBB's Biodiesel Education Network (BEN) Newsletter and Fuel Quality Guides to the 1000 plus members of the Minnesota Petroleum Marketers Association (MPMA). Hard copies of the Fuel Quality Guide and a CD version of its Biodiesel Quality Assurance video³ were handed out at workshops and at the MPMA Convention. MBC also responded to requests from fuel distributors for the CD version of the Biodiesel Quality Assurance Video that was passed along to their customers.

Advertising: MBC placed an advertisement in MPMA's newsletter with sources for information on biodiesel such as, NBB, the University of Minnesota's Center for Diesel Research and MBC. At MPMA's request, MBC published the results of the filter testing (see Fuel Sampling Kits below), an excerpt from EPA guidance on the illegal use of straight vegetable oil in diesel engines and the information piece "Applications of Biocide Products." For several months, this project promoted biodiesel fleet use with the "Biodiesel Fuels My Ride" advertisement.

³ <http://www.biodiesel.org/news/video-library?bcpid=590997673001&bckey=AQ~~,AAAAExwdOcE~,B2RKZahsXV-1xyHIPMsvnqj-QSWDLcij&bclid=590068864001&bctid=590989047001>

Educational Events: MBC participated in the 2007 and 2008 MPMA Convention and Trade shows where they discussed biodiesel -- B100 prices, tank maintenance, microbial contamination, cold weather operability of ULSD and cold weather blending capability at pipeline terminals. NBB held three additional fuel distributor meetings and was able to exceed the required project milestones. MEG Corp also led a successful seminar for MPMA staff to address the challenges following the introduction of ULSD and B2 in Minnesota.

Fuel Sampling Kits: MBC analyzed suspect fuel and filters received from distributors to determine the causes of plugged filters. Analysis was conducted at a third party lab. In general, filter issues were found to be related to microbial growth in fuel storage tanks and fuel systems. In response, MBC provided information to fuel distributors and end users on the proper use of biocides.

3.2.2 Targeting Minnesota Biodiesel Users - Trucks and Fleets

In response to the urgent need for action to address Minnesota biodiesel fuel quality issues, this task was updated to include Fuel Quality Testing along with Truck Driver Promotion.

Fuel Quality Testing (originally Truck Driver Communication): Minnesota did not have adequate resources to provide comprehensive biodiesel testing and requested support from NBB. This project was able to provide fuel testing, ensure biodiesel quality, provide a model for other states to adopt, and increase confidence among users. MEG Corp collected B100 fuel samples monthly at 3 biodiesel plants. The samples were sent to Magellan Labs for analysis and the results were posted on MBC's website. Throughout the course of this project, fuel quality improved.

Truck Driver Promotion: In collaboration with MPMA, MBC completed 16 educational and informational workshops (6 in FY06 and 10 in Q1 FY07) throughout Minnesota. The project's statements of work outlined 12 workshops but in response to MPMA's request and heightened concerns about biodiesel fuel quality within the state, more workshops were conducted.

NBB and its partners hosted a booth at the 2007 Minnesota Trucking Association and Trade Show Convention where there were over 200 participants. Most of the issues discussed were microbial/fungal and ULSD cold weather operability issues. NBB also participated in the Minnesota Truck Driving Competition.

MBC worked with the Minnesota American Lung Association (MNALA) to promote biodiesel as a clean-burning renewable fuel to truck drivers. NBB and its partners mailed brochures and surveys to approximately 25,000 diesel consumers identified by MNALA. MNALA also worked with mechanics and shops in the state, educating them on the benefits of biodiesel. With funding from the Minnesota Soybean Council, MNALA restarted the original "Driving MN Biodiesel" project.

Radio ads were created for “Biodiesel Day”. The effort promoted biodiesel and incentivized truck drivers to use biodiesel. Informational posters and literature were displayed and biodiesel fuel coupons were distributed at truck stops throughout the state. Informational materials were also used at the MTA’s annual meeting. In addition, MBC ran 13 “Soy Minute” radio spots featuring biodiesel experts and users.

MBC continued to distribute biodiesel information brochures specifically for the trucking industry. Some were distributed to trucking firms upon request. The remaining brochures were distributed at the Minnesota Trucking Association’s Annual Meeting.

3.3 Petroleum Terminal Education

Through this task, NBB was able to educate terminal operators and industry partners on the importance of biodiesel fuel quality, blending practices and Bioheat⁴. This task was completed in 2007.

3.3.1 and 3.3.2 Develop fuel sampling protocols for terminals using biodiesel and biodiesel blends and distribute training CDs to a minimum of 1000 people

NBB working with industry partners distributed more than 1200 CDs on Biodiesel 101, BQ-9000, Bioheat and blending practices. The discs were developed for distribution to each groups’ membership and to be available on the internet for review and printing. The recipients for the educational CDs were fuel distributors, terminal operators and other personnel involved with biodiesel distribution (*Deliverables 3.3.DL1 and DL2*).

3.3.3 Attended and spoke at industry trade shows

NBB set up training webinars with the Petroleum Marketers Association and conducted industry outreach at major conferences and tradeshow such as the Atlantic Region Energy Expo, SIGM and PLATTs. Section 3.4 of this report discusses a meeting where Fuel Distributor Education was conducted. At these events, NBB and its partners took the opportunity to educate terminal operators as well (*Milestone 3.3.ML1*).

3.3.4 Provided outreach services to 2-3 analytical laboratories

NBB contacted several analytical laboratories that dealt with petroleum terminals to assist them in understanding the ASTM D 6751 standards and promote their participation in providing analytical services for biodiesel testing (*Milestone 3.3.ML2*).

3.4 Fuel Distributor Education

⁴ Bioheat is traditional home heating oil blended with biodiesel. Bioheat blends usually range between 2% and 5%. The term Bioheat® is a registered trademark of the National Biodiesel Board and the National Oilheat Research Alliance.

The task provided biodiesel fuel education information to fuel distributors through advertising, brochures, articles, direct correspondence etc. Through this grant, NBB was able to participate in over 15 events and impacting hundreds of people across the nation. In addition, we were able to provide invaluable technical assistance to Colonial Pipeline and to the Underwriters Laboratory for fuel protocols. Articles were written for *Oilheat Magazine* and presentations were completed, shared and used whenever possible. Specific highlights that were successfully accomplished were:

1. Updated Bioheat fuel brochure for NBB
2. Placed ad for BQ9000 quality control in Biodiesel Magazine and the PMAA Journal (Petroleum Marketers Association of America).
3. Published fuel quality article in *Hydrocarbon Process* magazine.
4. Responded to more than 150 technical email or phone requests for assistance or clarification regarding biodiesel.
5. Attended and presented at the SIGMA and PLATT's conferences in October 2006.
6. Presented on maintaining fuel quality throughout the supply chain at SIGMA Kansas City meeting in December 2006.
7. Presented to 32 fuel marketing managers in Bloomington, IL. Topics covered included a biodiesel industry update, and overview of quality issues and tank and fuel management strategies.
8. Starting in 2007, NBB and partners presented or participated at meeting and conferences in Texas, the District of Columbia, California, Kansas, Minnesota, Florida, Montreal, New Jersey, Colorado, Wyoming, North Carolina, and South Carolina. Participants included Clean Cities Coalitions, government leaders, suppliers, educators, marketers, fleets, etc. Presentations included general information on biodiesel, handling, storage, etc.

3.5 Heating Oil Education Plan

Biodiesel in heating oil is called Bioheat. In 2006, the market potential for a 5% blend of biodiesel in heating oil was approximately 6.7 billion gallons annually. This project provided valuable support to educate the industry and consumers about the use of Bioheat. The education plan involved general biodiesel/Bioheat education training and fuel quality education. The following activities were completed in 2008.

1. NBB organized and presented at five webinars for PMAA; worked on industry outreach at the Atlantic Region Energy Expo -- a major conference and tradeshow for the oil heat industry; and planned three webinars for petroleum marketers. This included outreach to PMA members, review of a webinar presentation and rehearsing the presentation.



2. NBB working with AFS met with representatives of the Michigan Petroleum Marketers Association, W.A. Cleary Corporation and the State of Wisconsin to discuss Bioheat and using it as a fuel for industrial burners and boilers. AFS worked closely PMAA to secure 4 groups of 30 state leaders and constituents to provide Biodiesel 101 training programs.
3. The new Bioheat® logo was developed through a partnership between NBB/AFS and Greystone Associates. The design was for truck decal to be used in education packages.
4. AFS visited Boston Steel where fuel oil trucks are manufactured to assess the various configurations of the fuel delivery trucks. They also met with Massachusetts Oil Heat Council to promote biodiesel to the downstream market for heating oil.
5. PMAA market training modules and incorporating Bioheat training into training for oil heat technicians.
6. NBB/AFS responded to the National Oil heat Research Alliance (Huber) inquiries regarding complaints from Ling Island and New Haven on palm and soy biodiesel being used by Morgan Stanley and Northville Industries. Concerns arose in late 2007 concerning the introduction of palm oil in pipeline movements from Gulf Coast ending in Linden, NJ. AFS worked with NORA and Brookhaven National Laboratory to resolve the concerns.
7. The Bioheat task force focused on efforts to modify ASTM specification for heating oil to include up to 5% biodiesel in heating oil.

The Fuel Quality and Awareness Campaign, Task 3, was successful. As a result of this, hundreds of people were educated throughout the state of Minnesota and the nation about biodiesel. This effort provided invaluable training and outreach on topics including general biodiesel education (AKA “Biodiesel 101”), storage, filtering, handling, fuel quality, etc. NBB felt the project was invaluable to the industry.

Task 4: NREL United States Postal Service (USPS) Evaluation

The USPS fleet evaluation was added to the project in 2008 to replace Sub-Task 3.1.3 - Producer Education and Fuel Test Survey. NBB collaborated with the National Renewable Energy Laboratory (NREL) to complete the work. The Florida USPS evaluation and tear down project were one part of a larger fleet study conducted in multiple locations by NREL.

In this evaluation, five trucks operating on B20 fuel were compared to five identical trucks operating on standard #2 diesel fuel. The trucks were MY 2004 International 11-ton cargo vans equipped with International's DT466 engine. Operation and maintenance data was collected during normal vehicle operation and analyzed to evaluate



performance over a 12-month period (about 100,000 miles). Fuel and oil samples were collected and analyzed as part of the evaluation. An engine teardown analysis was also conducted. A comparative analysis and summary report of the project was written for NREL by Roush Technical Services, the company conducting the engine teardown. Their report was included in an internal document prepared by NREL titled, *NREL USPS B20 Study Engine Tear Down Report*. [\[4\]](#)

Evaluation and engine teardown costs were shared by NBB, NREL and USPS. The evaluation was carried out as planned, but due to an internal USPS spending freeze, the teardown was delayed. The Roush report found there were no significant issues or adverse conditions traced to the use of biodiesel fuel. Noted wear was considered normal for the length of service and mileage. The report also addressed the injectors – considered the most critical subassembly affected by fuel characteristics. The inspector was unable to distinguish between nozzles using B20 and nozzles using diesel fuel. This supported the supposition that a B20 blend could operate satisfactorily if the fuel blend met the quality, specification and stability standard (NREL, 2010).

Conclusions

Completion of the National Biodiesel Infrastructure Initiative had a strong positive impact on the biodiesel industry. The project's broad scope addressed the previous absence of solid, up-to-date information on biodiesel use in both the state of Minnesota and on a national level. Project partners reached out to fuel producers, distributors and fleet operators to provide current information. Needed testing within the industry was also conducted and the results were made available to stakeholders via online formats. With the exception of an incomplete secondary pipeline run, NBB and its partners were satisfied with the results of the initiative.

Pipeline Runs: Under the Petroleum Company Education and Pipeline Run Task, NBB partner, Northville Product Services found no adverse impacts to the base fuel specification of the blended B5 batch. All ASTM D975 specifications were acceptable, including no water or sediment traces. At the time of testing, however, there were no test methods available to determine the level of biodiesel in jet fuel below 1.7% by volume. Northville recommended developing a test method to accurately determine lower levels of biodiesel in jet fuel, which was subsequently done through work completed by the Energy Institute Joint Industry Project.

The project also led to the formation of the Pipeliner Biodiesel Steering Committee (PBSC) that was able to establish agreed to protocols for data collection on pipeline runs as well as identify and begin executing against the additional technical issues that need to be addressed to enable biodiesel blends to be moved on American pipelines.

Lubricity: The report prepared by Meg Corp of testing conducted by Magellan concluded that using biodiesel in place of lubricity additives could be a cost-effective and environmentally responsible way to achieve excellent lubricity in ULSD fuels. All the bio-blends decreased the lubricity standard of the ULSD samples to within specification.

Certification Standards Assistance: A major outcome of the initiative was UL's approval of B5 blends for all applications using ASTM D975 and D396 fuels beginning in 2010. Subsequently, the National Work Group on Leak Detection Evaluations (NWGLDE) approved leak detection equipment for B6-B20, and the US EPA approved underground tanks for B20 storage.

Infrastructure: NBB, in conjunction with its industry partner – Jefferson Biofuels, LLC, installed meter blending terminals at public locations in Kansas City and Jefferson City. Jefferson Biofuels considered the project to be a success and both facilities continue to operate.

Upstream Petroleum Outreach and Downstream Fuel Quality Awareness and Education Campaign: Research and development are meaningless unless the targeted audience learns about the results. NBB completed over six BQ-9000 seminars, wrote and distributed more than 1200 Biodiesel Education Network (BEN) newsletters, 1000 CDs and participated in more than 40 educational events. In addition, this task generated two BQ-9000 guidance documents and a BioHeat brochure. The seminars generated \$34,066 in registration revenue and were attended by several hundred attendees. The proceeds were used to fund additional project costs, including a fire safety training program prepared by the international Association of Fire Chiefs.

At the time the initiative was developed, it was expected the biodiesel industry would realize 370 million new gallons of production capacity in the BQ-9000 certification program. As of June 2007, one year into the project, production capacity was at 379.5 million gallons per year. There are currently 1.39 billion gallons of production capacity. Prior to DOE funding, there were only 6 accredited producers. Today there are 19 producers and 8 marketers in the program. More importantly, producer testing indicates that the industry went from 60% fuel quality compliance to 90% during the project period. This is due, in large part, to the education and training efforts of this project.

Without DOE support for the National Biodiesel Infrastructure Development Initiative, the National Biodiesel Board would not have been able to implement all the activities completed. Although, pipeline companies are willing to test biodiesel on their pipeline, these entities have not expressed interest in developing the methodologies needed to test methyl ester trail-back independently, primarily because biodiesel would be a small fraction of pipeline activities. However the impact on the biodiesel industry is significant.

Biodiesel continues to be a way to support the domestic fuel economy, as well as the agricultural community responsible for producing bio-fuels.

References

[1]

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[3]

National Biodiesel Accreditation Commission (2011, February). *BQ-9000 Producer Program Guidebook*, Revision 7. Retrieved from BQ-9000 Web site <http://bq-9000.org/documents/Producer%20Req%20Rev%207%20Final.pdf>.

[4]

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Appendix

NBB Infrastructure Development Project Jefferson Biofuels, LLC October 2010

Project Overview

The focus of this project was to install meter-blending terminals to assure accurate biodiesel blending and distribution while reducing costs to the end-user. Under this task, meter blending terminals were placed at two locations, in an effort to make biodiesel more available to both biodiesel marketers and end-users. NBB, in conjunction with its industry partner – Jefferson Biofuels LLC, installed a fully automated and meter blending terminal in Kansas City, KS. This terminal is operating successfully and sells approximately 30,000 gallons of biodiesel per month. The company has completed modifications to its existing site in Jefferson City. This site dispenses approximately 7,000-15,000 gallons per month.

Kansas City Terminal

1. **Site Address:** 3169 Dodge Road
Kansas City, KS 66115-1235

2. **Describe equipment installed by project:**
 - a) suction pump with electric motor
 - b) product measuring meter with ticket printer
 - c) vapor loading hose and vent
 - d) loading arm with dry break
 - e) electric solenoid valve on product line
 - f) Scully overfill protection system with ground
 - g) electronic customer account activator and software
 - h) insulated concrete building with heater
 - i) insulated/electric overhead security door
 - j) closed circuit security system with cameras and internet access
 - k) labor to install above
 - l) trucking to deliver portable building
 - m) crane to remove/replace canopy
 - n) crane to set building

Equipment already in place: 2-10,000 gallon underground tanks, automatic tank gauge, pavement, canopy

3. **Approximate date equipment installation was completed:** June 2006
4. **Describe activities at the project site:** 24/7 facility for on-site biodiesel blending
5. **Describe any challenges or difficulties encountered during implementation of the project and how they were resolved:**

It took several months to design and build a portable building to meet local building codes. The building housing the product pumping equipment was constructed at a remote location and trucked in and set at the project site. Therefore, it became necessary to remove the canopy in order to set the building. The canopy was replaced and the pumping equipment was set, wired and plumbed after setting the building.

6. Was this project a success? Describe how this project has met its goal to make biodiesel more available to both biodiesel marketers and end-users:

Jefferson Biofuels considered the project to be a success. The facility location is good given its close proximity to two refined fuels terminals making biodiesel available for blending to transporters and petroleum marketers.

7. Will this site continue to offer biodiesel now that this project is complete:

This location offers B-99.9 to blenders to make their own biodiesel blends.

Jefferson City Terminal:

1. Site Address: 1601 Christy Drive

Jefferson City, MO 65101

2. Describe equipment installed by project:

- a) electric solenoid valve on product line
- b) Suction pump with electric motor
- c) Product measuring meter with ticket printer
- d) Vapor loading hose and vent
- e) Loading hose with retractable (electric) hose reel with dry break
- f) Scully overfill protection system and ground
- g) Electronic customer account activator and software
- h) Insulated metal building addition with heater to house equipment
- i) Insulated/electric overhead security door
- j) 15,000 gallon above ground storage tank with valves and fittings
- k) Tank heater to heat product in tank
- l) Concrete secondary containment for storage tank
- m) Labor to install equipment

Equipment already in place: heated warehouse for 15,000 gallon storage tank

3. Approximate date equipment installation was completed: December, 2009

4. Describe activities at the project site:

24/7 facility for biodiesel on-site blending. We also have 24/7 facility for ethanol on-site blending. Complete petroleum bulk plant operation for refined fuels and lubes.

5. Describe any challenges or difficulties encountered during implementation of the project and how they were resolved:

The project required designing a system for loading trucks with a long hose from building to truck and then a system to retract the loading hose with its dry break head.

6. Was this project a success? Describe how this the terminal met its goal to make biodiesel more available to both biodiesel marketers and end-users:

The project was a success. Close proximity to a refined fuels terminal makes biodiesel available for blending to transporters and marketers.

7. Will this site continue to offer biodiesel blends now that this project is complete:
Yes.

**Jefferson Biofuels, LLC – Fuel Volume Report
October 2010**

	2008				2009				2010			
	1 Quarter	2 Quarter	3 Quarter	4 Quarter	1 Quarter	2 Quarter	3 Quarter	4 Quarter	1 Quarter	2 Quarter	3 Quarter	4 Quarter
	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sept	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sept	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep
Kansas City Terminal												
Total B99/B100 this quarter	21,734	16,001	26,208	21,865	10,143	9,859	22,535	21,929	9,286	5,218	13,147	14,254
Total 2% blend												
Total 5% blend												
Total 20% blend												
Total unblended	21,734	16,001	26,208	21,865	10,143	9,859	22,535	21,929	9,286	5,218	13,147	14,254
Average B99 price for quarter	\$2.70	\$3.57	\$4.32	\$4.04	\$2.98	\$1.76	\$1.91	\$2.14	\$2.20	\$2.42	\$2.88	\$3.43
Average Diesel price for quarter	\$2.62	\$2.96	\$3.73	\$3.54	\$2.15	\$1.36	\$1.66	\$1.90	\$2.05	\$2.17	\$2.29	\$2.25
Jefferson City Terminal												
Total B99 this quarter					19922	14141	15634	24616	15240	9391	15677	12134
Total 2% blend					1208	245	220	141	120	80	414	260
Total 5% blend					1040	400	300	650	1825	1500	2375	1475
Total 10% blend							48			600	36	
Total 20% blend					13659	6843	12401	16413	11160	6356	9002	8514
Total unblended					4015	6653	2665	7412	2135	855	3850	1885
Average B99 price for quarter					\$2.64	\$1.57	\$2.03	\$2.12	\$2.28	\$2.47	\$2.79	\$3.11
Average Diesel price for quarter					\$2.15	\$1.36	\$1.66	\$1.90	\$2.05	\$2.17	\$2.29	\$2.25

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