Oregon Environmental Council

# Drop by Drop

## *Voluntary Reductions in Diesel Emissions from Stationary Sources*


A Report by the Oregon Environmental Council

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by Katharine Hyzy



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Oregon Environmental Council

The Oregon Environmental Council safeguards what Oregonians love about Oregon – clean air and water, an unpolluted landscape and healthy food produced by local farmers. For nearly 40 years we've been a champion for solutions to protect the health of every Oregonian and the health of the place we call home. We work to create innovative change on three levels: we help individuals live green; we help businesses, farmers and health providers thrive with sustainable practices; and we help elected officials create practical policy. Our vision for Oregon includes solving global warming, protecting kids from toxins, cleaning up our rivers, building sustainable economies, and ensuring healthy food and local farms. Join thousands of Oregonians by becoming a member today at www.oeconline.org.

# Drop by Drop: Voluntary Reductions in Diesel Emissions from Stationary Sources

## Executive Summary

Reducing pollution through voluntary means is no easy task, especially in the business world. However, it can be accomplished. Establishing strong working relationships between private, public and non-profit institutions is key to getting individuals and businesses to take the leap.

Over the course of three years, the Oregon Environmental Council sought to reduce diesel emissions from stationary sources through voluntary measures. We attempted to focus our efforts on sources that would affect North Portland, where high concentrations of both poverty and diesel pollution exist.

First, OEC created an inventory of stationary sources of diesel pollution in Portland. Using the inventory as a starting point, OEC then identified three target markets and developed voluntary diesel emissions reduction strategies for each. These three markets—home heating oil consumers, Portland Public Schools, and hospitals—were deemed appropriate because they affected at-risk populations and seemed like areas where voluntary emissions reduction strategies could truly make a difference.

In all, OEC helped accomplish emissions reductions in these three markets through a combination of pass-through grants and consumer education. Our efforts to promote the use of cleaner-burning biodiesel and efficiency measures resulted in the displacement of an estimated 54,000 gallons of regular heating oil, and an additional 4,500 gallons of even dirtier oil #5.[1] This means that the creation of the following pollution is avoided each year:

- 4140 pounds of sulfur oxides (SOx)
- 723 pounds of nitrous oxides (NOx)
- 216 pounds of particulate matter (PM)
- 194 pounds of carbon monoxide (CO)
- at least 112 tons of carbon dioxide (CO2)

As our inventory discovered, diesel pollution from stationary sources is a small fraction of the problem. Yet as these reductions show, even fractions can make a difference. These voluntary reductions have also greatly benefited from the introduction of ultra-low sulfur diesel (ULSD) into the market this past year. As cleaner fuel becomes the norm, it builds upon the work of many communities dedicated to addressing Portland's diesel air pollution issues.

## Project Background

### Local Concern about Diesel Emissions

In Oregon, and in Multnomah County, diesel emissions are one of the leading causes of cancers related to air pollution, as well as a major trigger of asthma and other respiratory illnesses. According to EPA National Air Toxics Assessment (NATA) estimates[2], residents of Multnomah County face a cumulative added lifetime cancer risk from hazardous pollutants of 1 in 1,000; of this, diesel pollution alone is estimated to account for 75% of this risk.

The Albina neighborhood, a traditionally lower-income community where nearly half of Portland's people of color reside, bears a disproportionate share of hazardous air emissions: it holds just 13% of Multnomah County's population but receives 55% of its hazardous air emissions. The city of Portland's largest industrial zone lies just west of the Albina community, which is also bisected by two interstate freeways (I-5 and I-84) that carry substantial traffic.

In 1998, the Oregon Environmental Council (OEC) and the Environmental Justice Action Group (EJAG), a community group serving North Portland residents, collaborated on a year-long project to identify and begin to address environmental justice concerns in the Albina community. Working with local residents, OEC and EJAG created a community-based GIS map to provide a clearer picture of the Albina community's environmental health. The project identified a number of issues of community concern. Topping the list were concerns about asthma from diesel pollution, low birth weights, and high blood levels of lead. The project culminated in a resource guide on environmental health issues for Albina residents.

Diesel is a leading air toxic of concern. Diesel emissions include tiny particles that are toxic and can be breathed deeply into the lungs where they can cause a range of health problems from asthma to increasing the risk of cancer.

Because diesel engines are widely used in marine vessels, heavy duty trucks and construction equipment, diesel emission levels in parts of Oregon exceed healthy levels.

*-Oregon DEQ website*

## Understanding Diesel Pollution

Diesel emissions are unique. Unlike other air pollutants, diesel emissions are made up of a host of different compounds that cause health and environmental issues. Among these are four "criteria pollutants": sulfur oxides, nitrogen oxides, particulate matter, and carbon monoxide. The EPA has set national standards to control criteria pollutants because of the particular health and environmental threats they pose.

### Sulfur Oxides (SOx)

Sulfur is a naturally occurring element in raw petroleum and in most petroleum distillates like diesel. The amount of sulfur in a diesel fuel directly affects the amount of hazardous pollution it creates when burned. Sulfur contributes to the formation of nitrous oxides and particulate matter, both of which have significant health impacts, particularly for children. When burned, some of the sulfur in the fuel forms sulfur oxides, which are significant contributors to smog formation and a catalyst for the creation of acid rain. In addition to its role as a catalyst for the formation of other pollutants, SOx contributes to incidences of respiratory illness.[3]

Much like lead in gasoline, it is possible to remove sulfur during the refining process. New regulations taking effect in 2006 and 2007 have dramatically lowered the sulfur levels in fuel used for on-road and off-road applications to 15 and 500 parts per million (ppm), respectively. In actuality, the majority of the diesel fuel now sold in the Pacific Northwest, regardless of application, is likely to be the 15 ppm ultra-low sulfur diesel (ULSD). Oregon and Washington's diesel is provided primarily by five refineries located in the Seattle area. Of these refineries, only one continues to produce the 500 ppm sulfur diesel, which greatly restricts its availability.[4]

By 2012, all diesel fuel sold in the U.S. will contain no more than 15 ppm of sulfur. In addition to creating an immediate and dramatic reduction in diesel emissions, this fuel allows the use of aftertreatment technologies such as particulate traps or oxidation catalysts on diesel-fired equipment to further reduce

Reducing emissions from diesel engines is one of the most important air quality challenges facing the country…. Over the next twenty years millions of diesel engines already in use will continue to emit large amounts of nitrogen oxides and particulate matter, both of which contribute to serious public health problems.

These problems are manifested by thousands of instances of premature mortality, hundreds of thousands of asthma attacks, millions of lost work days, and numerous other health impacts.

*-US Environmental Protection Agency website*

These programs will yield enormous long-term benefits for public health and the environment.

By 2030, when the engine fleet has been fully turned over, PM and NOx will be reduced by 250,000 tons/year and 4 million tons/year, respectively.

This will result in annual benefits of over $150 billion, at a cost of approximately $7 billion.

*-US Environmental Protection Agency website*

diesel emissions. Such technologies are required under new engine standards being phased in starting in 2007.

**Particulate Matter (PM)**
Particulate matter, or soot, is a mixture of extremely small particles and liquid droplets. These particles include heavy metals, nitrogen and sulfur oxides, volatile organic compounds (VOCs) and other elements. The danger of PM stems from its ability to serve as a vehicle for transporting these elements deep inside the body, where they cause a variety of difficulties, including respiratory and circulatory health problems. The smaller the particle, the greater the damage it can cause. Diesel emissions are laden with particulate matter, including particles small enough to cause harm.[5]

**Nitrogen Oxides (NOx)**
Nitrogen oxides are formed when petroleum products are burned. NOx emissions contribute to the formation of ground-level smog, acid rain, and particulate matter. In addition, nitrous oxide (N2O) is a greenhouse gas contributing to global warming.

**Carbon Monoxide (CO)**
Carbon monoxide is formed by the incomplete combustion of organic materials such as wood and petroleum. In high concentrations, CO causes cardiovascular and nervous system failure, but it is primarily a health concern because it contributes to the formation of ground-level smog.

**Mercury (HG)**
Mercury is a heavy metal which enters the environment through multiple exposure routes (including coal-fired power plants, cement manufacturers and consumer products) and changes to methylmercury. Methylmercury harms nervous system development and can harm organs.

The size of particles is directly linked to their potential for causing health problems.

EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs.

Once inhaled, these particles can affect the heart and lungs and cause serious health effects.

*-US Environmental Protection Agency website*

**Oregon Environmental Council's Diesel History**

Diesel is among the pollutants on OEC's "Dirty Dozen" list. This list is comprised of a dozen key chemicals or chemical compounds commonly found in Oregon at levels determined to cause health and environmental impacts, particularly to children. Diesel pollution is also identified as a "leading air toxic of concern" by the Oregon Department of Environmental Quality. Despite the pervasiveness of diesel pollution in Oregon, it is a problem that can be—and is being—solved, one piece at a time. Over the past five years, the EPA has focused efforts and resources on addressing America's diesel pollution issues through the National Clean Diesel Campaign, with an emphasis on programs which promote voluntary emissions reductions—in effect, finding ways to encourage citizens and businesses to choose cleaner fuels or to use aftertreatment technologies to reduce emissions, instead of achieving emissions reductions through regulatory means alone.

Seeking to expand its work on diesel emissions, OEC responded to a Request for Proposals from the EPA's Community Air Toxics program seeking grant applications to reduce diesel emissions from stationary sources. OEC was awarded $97,000 over the course of two years (later extended to three years) to fund both an inventory of stationary sources of diesel pollution in the Portland Metro area and to develop strategies to promote voluntary reductions in emissions from these sources.

OEC is also working to reduce emissions from construction equipment via a separate EPA grant and to promote the use of biodiesel in a variety of diesel-powered engines.

*Solutions*
In general, there are three ways to reduce emissions from stationary diesel sources: install retrofits that will remove some of the emissions from the exhaust, use less fuel through efficiency measures, or use a cleaner-burning fuel.

**Retrofits** are typically found on large industrial equipment or mobile emissions sources such as trucks. Installed by trained mechanics, the units are typically designed for the application at hand, and can range in cost from $600 to the tens of thousands of dollars for a large factory. Retrofits for smaller sources, such as home heating systems, are virtually unheard of, as these sources are not regulated and there are few programs offering incentives for the use of retrofits on these smaller units.

**Fuel efficiency** is an important piece of reducing emissions from stationary sources. Simple measures such as regular maintenance, installing programmable thermostats, and replacing older equipment can save money, extend the life of equipment, and reduce emissions at the same time.

**Using cleaner-burning fuel** can be the simplest way to reduce emissions. Biodiesel blends and ultra-low sulfur diesel (ULSD) are now readily available to consumers and provide significant emissions reductions for as little as a few extra dollars a month. The emissions reductions and ease of fuel switching made promoting these cleaner-burning fuels OEC's primary strategy for reducing emissions, particularly in the home heating oil market.

## Creating an Inventory of Stationary Sources of Diesel Emissions

The inventory of stationary sources was compiled over the course of several months, using data from the Oregon Department of Environmental Quality's (DEQ's) air quality permits office, the State Fire Marshal's Right-To-Know database, and the Oregon Department of Energy. Because air quality permits are not required for individual home heating oil systems, OEC relied on industry estimates of households heating with oil in the Portland metro area.

For the purposes of the inventory, OEC relied on EPA's guidance on what to consider "stationary" and "diesel." Stationary sources, simply put, are those which do not move. In Portland, this means boilers, large backup generators, oil furnaces, and a handful of large industrial equipment. It excludes all construction equipment, mobile generators, vehicles, and other diesel equipment on wheels.

Diesel fuel includes the full range of petroleum distillates marketed as diesel, including diesel #1 (typically used only in cold climates), #2 (until October 2006, highway-grade fuel; now off-road fuel), and the heavier, dirtier-burning grades #3-#6. Only #2 and #5 (also known as Bunker C) showed up in our inventory.

Clear patterns emerged from this data, which provided OEC with direction for choosing target markets for implementing voluntary emissions measures. Although there are a number of individual industrial sources responsible for significant diesel emissions in North Portland, conversations with DEQ permit writers convinced us that these businesses were highly unlikely to be receptive to voluntary emissions reductions without significant financial incentives.

This left a field populated largely by four sources: backup generators associated with communications towers, boilers at Portland Public Schools, boilers and backup generators at hospitals and a few industrial facilities, and home oil furnaces. Because backup generators typically run only a few hours a year, they represent only a small amount of diesel emissions in Portland. The following sections explain OEC's efforts to promote voluntary emissions among our three target markets: home heating oil, Portland Public Schools, and hospitals.

## Transforming a Market: Home Heating Oil and Biodiesel

Biodiesel's ease of use and availability in the Portland Metro area made it OEC's cleaner-burning fuel of choice for emissions reductions in the home heating oil market. Typically made from soybean or canola oil, biodiesel is a home-grown fuel that can be produced from crops grown right here in the Northwest, providing economic as well as environmental benefits. The Northwest is one of the hot spots for biodiesel use and production, but it has primarily been used in vehicles, with the expansion of biodiesel use into construction and stationary equipment a relatively recent development.

Over the course of the past three years, OEC has successfully worked to expand both the availability and use of biodiesel blends in the heating oil market. This success has hinged largely on working with leaders in the heating oil industry to educate consumers about the benefits of using biodiesel heating oil blends.

Less than ten percent of homes in the U.S. heat with oil (diesel #2), and 78% of those households are located in the Northeast.

Only 3% of homes along the West Coast—roughly 250,000—heat with oil.
*-US Department of Energy*

### Market Profile

According to industry estimates,[6] there are approximately 50,000 homes in the Portland Metro area heating with oil. An average 1,800 square foot home in Portland will use approximately 500-600 gallons of oil during the winter months (November-March). Collectively, these homes create at least 62.5 tons of carbon monoxide, 532.5 tons of sulfur oxides, 225 tons of nitrogen oxides, 37.5 tons of particulate matter, and 21.5 pounds of mercury.[7]

### Biodiesel and ULSD

Blending as little as 20% biodiesel (B20) with regular heating oil can result in significant emissions reductions. Laboratory testing of this B20 blend in a range of commercial and residential heaters showed very good combustion stability, lower smoke numbers, and noticeably reduced fuel oil and combustion odors. Compared to emissions from regular heating oil, emissions of carbon monoxide were reduced by 12.6% and air toxics by between 12-20%. B20 also reduces particulate matter emissions by 12%.[8]

Furnaces and boilers burn fuel at higher temperatures than a standard diesel engine. This translates into different emissions, too—for example, biodiesel blends do not cause elevated NOx emissions in furnaces, though they do in a diesel engine. [14]

In addition to the environmental benefits of using B20, there is some future promise for higher blends. Limited testing of blends of B30 to B50 demonstrate that these higher blends can work in regular oil heating systems with some modifications, and anecdotal evidence from biodiesel enthusiasts experimenting with pure biodiesel (B100) indicates that it too can be used to heat homes, though using B100 does require more extensive system modifications than other systems.

With ultra-low sulfur diesel (ULSD) becoming the standard for all on-road diesel fuel sold in the U.S. as of November 2006, the nation's off-road supply is also significantly cleaner. The cost and complication of producing and maintaining many different grades of fuel is more than some refineries are willing to address, and so off-road fuel, though not labeled as ULSD, is often at or near the 15 ppm sulfur mark of ULSD. This is especially true in the Northwest, where only one refinery continues to produce the 500 ppm sulfur diesel. However, heating oil customers should not assume their heating oil is a cleaner grade.

## Additional Measures

The Oregon DEQ recommends home oil furnaces and boilers receive an annual check-up. These check-ups, performed by a certified professional, typically include a cleaning of the heat exchanger, burner adjustment, and filter replacement if needed. Keeping a heating system clean reduces emissions and maximizes efficiency—according to the EPA, annual maintenance results in using 13% less fuel.[9]

In addition, simple efficiency-enhancing measures such as installing programmable thermostats, increasing insulation in homes, and replacing older equipment (particularly systems more than 15 years old, which predate new efficiency standards for oil furnaces) can provide a return on investment ranging from 15% to 124%, making a home more comfortable while also conserving fuel.

Switching to natural gas is also an option, though an expensive one, as installation of a new heating system can cost thousands of dollars. The cost makes this an option only for relatively affluent homeowners.

## Identifying Allies

For the most part, voluntary emissions reductions programs have focused on promoting reduction strategies to commercial and industrial sources, and not to individual consumers. Choosing to focus on the home heating oil market therefore provided us with some exciting challenges, as we had no real model for success. However, we knew that in order for consumers to purchase biodiesel heating oil blends, they would first have to be able to find them. When we began this work in

2004, only two heating oil companies in the Metro area even offered B20 heating oil—Albina Fuel and StarOilco. OEC set out to determine why.

Over the course of several months, OEC conducted interviews both in person and via phone with executives at four of the leading heating oil providers in the Portland Metro area. These interviews were designed to provide us with a richer understanding of the heating oil consumer as well as of those providing the heating oil. We were very interested in learning what heating oil providers believed about biodiesel. Even more important was the opportunity to lay the groundwork for forming some solid relationships with distributors. Future work allowed us to learn still more about the heating oil industry.

**Barriers for Biodiesel Heating Oil**

There are a number of factors which complicate the introduction of biodiesel into the heating oil supply. Heating oil's declining popularity, lack of awareness in the heating oil industry, and limited availability have all contributed to keeping biodiesel blends out of consumers' heating oil tanks.

With the advent of the modern natural gas pipeline system, heating oil furnaces have declined in popularity. Even in areas such as Eastern Oregon, where natural gas is not available, propane or electric heaters dominate the market. Heating oil companies, once mostly small, family-owned businesses, have been forced to diversify by offering additional services, selling off to larger companies, or going out of business altogether. Remaining heating oil distributors tend to rely on other services for the bulk of their income, keeping heating oil delivery as a relic of earlier times.

Because heating oil is a small part of the business for most heating oil distributors, there has been little work within the industry to continue innovating and developing ways to remain competitive, whether it is with other heating options or among themselves. Offering a new product, such as a B20 heating oil, is more trouble and risk than most heating oil providers have been willing to consider. In addition, most heating oil distributors in Oregon knew relatively little about biodiesel or how to use it in heating oil applications.

In addition to the lack of awareness of B20's potential, getting biodiesel blends can be quite a challenge for heating oil providers. All providers fill their trucks at a "rack"—a storage facility that offers a range of liquid petroleum products. Although there are dozens of home delivery companies listed in the Yellow Pages, only a handful of these providers have a rack of their own. Most depend on just a few racks owned either by other distributors or by the refiners themselves. Both Albina Fuel and StarOilco, the two heating oil providers already offering B20 to their customers

when OEC began this project, own their own racks and could dedicate space to storing B20. Since installing a new tank at a rack can run over $10,000, dedicating a tank to B20 is a significant financial investment for a small company.

Running a fuel delivery truck is also a significant expense for distributors. Paying a driver to transport and deliver fuel is costly, as is the fuel used to run the delivery trucks. Since distributors often operate on a very narrow profit margin of just pennies per gallon, a successful business depends on efficient delivery routes and minimizing the number of delivery trucks. Switching from one type of heating oil to two can be less efficient, particularly as the new product is being introduced. Customers asking for B20 may be scattered across the city, and as the delivery truck can only carry one type of fuel at a time, this can lead to long distances between customer deliveries and longer hours for the driver.

## Moving Ahead

With these barriers in mind, OEC set out to fulfill a list of objectives that would increase sales of cleaner-burning biodiesel heating oil blends in the Portland Metro area. These included:

- Form strong working relationships with leaders in the local heating oil industry
- Educate heating oil providers about biodiesel
- Develop marketing materials for promoting B20 heating oil to customers
- Educate heating oil customers about B20 heating oil through marketing campaign
- Educate other sectors of the heating oil industry

## Working Relationships

OEC quickly found strong support from two distributors, StarOilco and First Call Heating and Cooling. StarOilco has sold biodiesel products to its customers since 2002 and began offering B20 heating oil in 2003. A much smaller company than Albina Fuel, heating oil delivery accounts for a far greater share of StarOilco's business, and promoting biodiesel products has become one of the company's primary marketing pushes.

First Call, one of the largest heating oil distributors in Oregon, is a large company providing a range of services including sales and service of a variety of heating and cooling systems. First Call owns many smaller heating oil delivery companies throughout Oregon. First Call began to offer B20 blends in home heating oil in March 2006. As an industry leader, the company quickly became a reliable partner for OEC in the home heating oil industry, one that carried a level of influence among its peers that would have been impossible for OEC to achieve independently.

**Education, Resources, and Community**

Educating heating oil distributors about B20 heating oil took many forms. The first of these was attending a meeting of the Oregon Petroleum Association (OPA) Marketing Committee. Representatives from a half-dozen Metro area heating oil providers were on hand to learn about OEC and biodiesel. Although initially greeted with suspicion, OEC was able to share some basic information about B20 heating oil and build a modicum of trust within the heating oil community. Beyond this meeting, StarOilco and First Call's advocacy for B20 helped spark additional interest in the community.

From there, OEC moved on to working with the chair of the OPA Marketing Committee and OPA's public relations firm to develop marketing materials for B20. These materials were developed according the marketing needs expressed by distributors. First among these was the creation of a regional logo to promote biofuels. Because few distributors have much in the way of a marketing budget, generating marketing materials to promote a new product like B20 heating oil is typically beyond their reach. The Northwest Biofuels logo was designed to give biofuels (including B20 heating oil) users and marketers an easy and standardized means of promotion.

By "branding" biofuels, our hope was to strengthen regional awareness of biofuels by reducing the confusion caused by a multiplicity of logos. It also provided OEC with an opportunity to emphasize the local economic benefits of biofuels, a value which transcends most political and ideological boundaries. The logo was then made available for any company or individual to use, free of charge. OEC also created large truck decals which were sold at cost, and static cling stickers bearing the logo for homeowners to place in their windows.

Most distributors bill their customers with a "doorhanger" envelope left on the front doorknob when a tank is filled. These doorhangers often contain promotional materials, and so we developed an insert providing some simple facts about biodiesel blends. The design left space for a company to insert its own contact information or logo, and though in color, was a design that would reproduce well in black and white. This design was also made available to distributors, who then paid

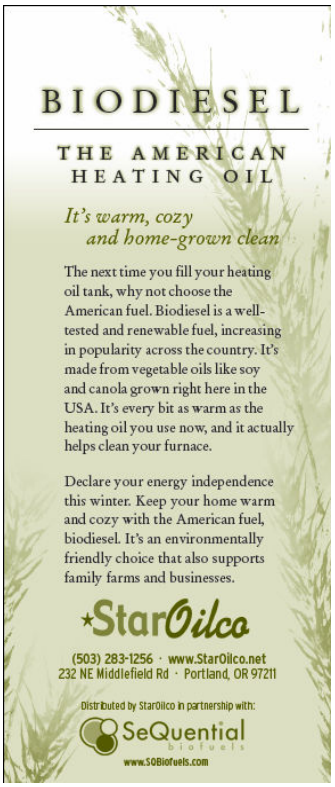
for the printing. Stickers bearing a complementary design were also created, for use on bill headers.

With these materials in hand, OEC and OPA developed an educational seminar about using biodiesel as heating oil. OPA's support and promotion helped to legitimize the event, which was a tremendous success. Held in January 2006, nearly thirty representatives from the heating oil community attended from around the state, including at least seven from the Metro area. A reporter who attended wrote an article about the rising popularity of B20 heating oil, which was picked up by at least three different papers across the state.

This educational seminar served a purpose beyond providing answers for curious distributors: it also served as a staging ground where distributors could see what the competition was up to—an opportunity to get inspired to keep up with the Joneses, so to speak. It was at this event that First Call announced they would begin offering biodiesel to their customers that spring, and participants had the opportunity to hear directly from their peers about the successes they were having with biodiesel heating oil. Indeed, it wasn't long after this seminar before several more distributors announced they were also going to begin offering B20 heating oil.

One of the keys to success, as our partners pointed out to us early on, is to truly transform the marketplace from one where biodiesel is regarded with suspicion or derision to one where everyone in the industry is knowledgeable about it and more or less supportive of its use as a heating oil. It is only then, when everyone from distributors to realtors and HVAC service technicians—in essence, anyone a heating oil consumer may regard as a trusted expert—accepts biodiesel, that it stands a chance of becoming commonplace.

To this end, OEC helped organize a seminar on biodiesel heating oil for HVAC technicians in October 2006. Though sparsely attended, the audience was enthusiastic. OEC also paid for the production of stickers using the regional logo that can be placed on oil furnaces to identify them as biodiesel compatible. Used by technicians at First Call and a handful of independent operators whenever they service an oil furnace, these serve as another way to get the idea of biodiesel heating


oil in front of consumers. Several hundred of these stickers were produced by OEC, and the design is available for service providers to produce more if they wish.

In fall of 2006, Mark Fitz of StarOilco organized a day-long class on biofuels at Portland Community College which targeted decision-makers and community business leaders. A portion of the class was dedicated to biodiesel heating oil, and OEC provided materials and expertise to support the class. Nearly 30 people attended.

OEC also reached out to realtors via informational presentations and materials. Since realtors frequently sell homes with oil furnaces, they were a logical educational outlet.

In May 2007, OEC and First Call President Molly Brady hosted a well-attended lunch seminar at Coldwell Banker Barbara Sue Seal Properties' flagship office in Beaverton, Oregon. About 50-60 realtors attended and asked questions about oil furnaces, pollution, and biodiesel usage. Based upon the questions asked and comments received, it was clear that the seminar was informative and of value to their business.

Based upon this seminar and subsequent discussions with real estate professionals, OEC created a fact sheet for realtors and their clients. This fact sheet provides information about home oil furnaces, efficiency measures, biodiesel, and real estate transaction-related issues, like service contracts. Nearly 2,000 of these fact sheets were distributed to the offices of real estate professionals in Portland and some surrounding areas. The feedback from these was positive. At least two realtors known to OEC developed articles based on the information OEC provided for their personal newsletter to clients.

In summer 2007, in preparation for the upcoming winter season, OEC contacted two non-profits in the Portland Metro area that help elderly and lower-income residents meet their energy needs to assess the viability of funding oil furnace tune-ups to increase boiler efficiency, reduce pollution and save consumer dollars at the same time. One group, the Community Energy Project, offers similar home efficiency assistance, but not for heating oil systems. By making pass-through grant funds available, OEC was able to coordinate with the Community Energy Project to

Home Heating with Biodiesel

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It's Good For Your Environment!

Facts for Realtors

Answers to Five Common Questions That Buyers and Sellers Should Ask About Oil Heat:

"My clients ask sooo many questions about oil tanks, and your flyer "Answers to the 5 Common Questions… About Oil Heat" is perfect."

*--Allie Jordan*
*Broker*
*RE/MAX Equity Group*
*Portland, OR*

contract these services to Portland Green Heat—a Portland company specializing in preventative maintenance techniques for oil furnaces, particularly those using or switching to B20.

During the coming winter, Community Energy Project will work with Portland Green Heat and others to improve the energy efficiency and promote the use of biodiesel in 50-60 home oil furnaces. The improvement in fuel efficiency (approximately 13% reduction in fuel use) and greater use of biodiesel will reduce harmful emissions, and the homes being serviced are exactly the kind identified by OEC as a high-priority: elderly and low-income citizens who cannot afford simple preventative measures.

Finally, OEC was also able to provide information to the owners of the few oil-heated large industrial boilers in Portland. These companies, identified in OEC's stationary diesel inventory, received copies of OEC's 2006 report "Toxics Reduction through Energy Efficiency for Boilers," which describes how efficiency measures can reduce pollution and help the bottom line, along with a letter listing biodiesel and other resources to help these industries voluntarily clean up their boilers.

**Marketing Matches**

One of the goals of the EPA grant was to make sure others were helping to carry out the work, be it through in-kind donations of time or financially. Our partners at StarOilco and First Call gave generously of their time, and Lloyd Maris, the PR firm OEC contracted with to design the collateral materials, contributed their talents at drastically reduced rates.

In addition, OEC's modest efforts to help market biodiesel heating oil inspired others to take action. StarOilco reached out to several of its competitors, who then pooled resources to run a two-week marketing campaign on a local AM radio station. First Call contributed space in their biannual newsletter, sent to their client base, which consists of approximately 75% of home heating oil customers in the Metro area, and contributed to extensive articles about B20 heating oil on at least three separate occasions. They also used a direct mail service to send ads about biodiesel, based on OEC's doorhanger design, to 10,000 households in the Metro area. These efforts helped to educate consumers about B20 heating oil and to raise the profile of its availability.

**Availability**

Since the inception of this project in November 2004, the availability of biodiesel heating oil in the Portland Metro area has expanded exponentially. OEC does not pretend to claim full credit for this transformation, but we do believe that our efforts helped to spark this change.

By January of 2006, the number of distributors offering B20 heating oil to their customers had grown from two to six, including four of the largest heating oil distributors in the Metro area: Albina Fuel, Carson Oil, First Call Heating and Cooling, and StarOilco. In addition, at least 19 heating service companies were offering B20 biodiesel heating oil as part of their services by July 2007. Cumulatively, the four largest heating oil suppliers alone account for around 90-95% of the Portland heating oil market; with other carriers also offering biodiesel delivery, it is safe to say that acquiring biodiesel heating oil in Portland is now easy to do.

Determining the exact amount of B20 sold for home heating oil over the course of this project is difficult. Understandably, heating oil suppliers were reluctant to share this information with a group like OEC, and reluctant to release trade secrets. The heating oil market is highly competitive; gaining or losing even a few customers can impact bottom-line figures. Some providers did share their sales totals with OEC, however, allowing us to extrapolate a general figure.

Since the introduction of B20 to the home heating oil market in 2002, the total has grown from the low tens of thousands, at most, to roughly 250,000 gallons by the end of 2007. If the entire winter season of 2007-08 were taken into account, the figure would be higher. However, given the dramatic rise in both knowledge of and demand for biodiesel, it's difficult to extrapolate beyond the end of 2007.

**Results**

Given that about 50,000 homes in the Portland metro area rely on home heating oil, consuming between 500-600 gallons of home heating oil per season, the total usage is around 25-30 million gallons. By using approximately 250,000 gallons of B20 home heating oil, these residential furnaces avoided putting about 99 lbs. of particulate matter, 157.5 lbs. of carbon monoxide, and 839,400 lbs. of carbon dioxide[10] into Portland's air.

There are other significant reductions as well. Using B20 instead of standard petroleum diesel reduced air toxics by as much as 20%, mutagens by 20%, and unburned hydrocarbons by 20%[11] versus what would have been burned in a similar amount of standard diesel.

Furthermore, the pass through funds enabling Community Energy Project to fine tune oil furnaces and improve efficiency has additional beneficial effects. Although these benefits are more difficult to quantify, improving the burning efficiency of 50-60 homes will certainly reduce diesel pollution in the neighborhoods most adversely affected by it.

## Lessons Learned

*Relationships Matter*. OEC simply would not have been effective at promoting biodiesel heating oil without support from leaders within the industry. There is no better, more efficient way to reach the potential consumers of biodiesel heating oil than through the channels already established by the distributors. Distributors pride themselves on personalized relationships with their customers and work hard to build a base of trust with them—which is far more than OEC could ever hope to do on its own in a limited period of time.

*Results Take Time*. It took OEC more than six months to identify potential partners, and then several more to bring the relationship along to the point where we could accomplish significant tasks together. We were a year into what was to be a two-year project before we could embark upon any significant outreach to the rest of the heating oil industry. It is only now, three years since the inception of the project, that we are seeing significant emissions reductions.

## Portland Public Schools: A Vulnerable Population

### Profile of Portland Public Schools

Serving 47,000 students within Portland's city limits, Portland Public Schools (PPS) maintains nearly 100 facilities across the inner Metro region. The majority of these are schools. As with many school districts across the country, PPS operates on a shoestring budget. In the past few years, teachers have been laid off and schools have closed as PPS has struggled to make ends meet.

Our first draft of the stationary diesel inventory placed 85 of PPS' facilities on our list. Of these, the records we used to compile our inventory showed 77 were heating with oil #5, also known as Bunker fuel. Oil #5 is a very low grade of fuel, so thick with residues, waxes and other undesirables that it is required to contain approximately 20% diesel #2. It contains up to 3% by weight sulfur—tens of times greater than the sulfur levels in diesel #2. Oil #5 must be heated in order to become liquid enough to use as a heating fuel. The remaining eight facilities used diesel as a backup fuel, burning approximately 50,000 gallons of diesel #2 annually.

These 77 schools were responsible for a total of 1,823,730 gallons of oil #5 being burned annually. None of these facilities had any pollution controls. Using EPA emissions factor estimates adjusted for boilers using oil #5, these schools emitted a total of 361.8 tons of SOx, 50 tons of NOx, 13 tons of PM 2.5, and 60 pounds of formaldehyde. In all, 35 of these schools were located in North Portland.

### Children and Diesel Pollution

Although diesel emissions are harmful for everyone, they pose a particular risk for children. Because children's respiratory systems are still developing, pollution poses a greater health threat for them. Also, since children breathe 50 percent more air per pound of body weight than adults, they are literally exposed to more pollution.[12]

Children make up 25 percent of the population, but comprise 40 percent of all asthma cases.
*-EPA website*

In the past twenty years, asthma has become the most common chronic disease of childhood and a leading cause of

disability among children.[13] Diesel emissions, particularly fine particles of soot associated with burning diesel, have been linked to increased rates of asthma as well as to triggering asthma attacks. In North Portland, residents report higher-than-average asthma rates, and many have expressed concern for their children's respiratory health.

**Addressing the Problem**

Portland Public Schools is aware of the need to convert its boilers and has been working to do so for several years. The new boilers employ dual-fuel burners, allowing PPS to use diesel when natural gas costs are too high.

In 2001, the Oregon Department of Energy's Small Scale Energy Loan Program issued a letter of credit to PPS for $2 million in low interest fixed rate loans. Nike used Oregon's Business Energy Tax Credit pass-through option on their behalf and provided a cash incentive for the switchovers. These funds provided for the conversion of 38 boilers to natural gas, and burners were upgraded and/or replaced at 19 schools. The conversions have taken place over time, and as additional funds have been found, more boilers have been added to the list.

As of fall 2006, 28 schools had been converted to natural gas boilers. This left 57 schools still in need of new boilers, using approximately 970,000 gallons of oil #5 annually, responsible for 190.3 tons of SOx emissions, 26.6 tons of NOX, and 7.11 *tons* of PM 2.5. Approximately 26,000 gallons of diesel are used annually. PPS was now at the end of its funding for conversions, with no new sources immediately apparent.

The EPA's established daily limit for exposure to PM 2.5 particles is 35 micrograms per cubic liter of air.

One pound equals more than 450,000,000 micrograms.

**Moving Ahead: Biodiesel for PPS?**

PPS contracts with Albina Fuels for all its heating oil deliveries. Albina provides a B20 heating oil blend to its customers. Unfortunately, burners designed to use oil #5 are different enough that biodiesel may not work in them. The cost of a B20 blend, nearly double that of oil #5, is prohibitive for PPS; even the $.20/gallon premium associated with switching to B20 as a backup fuel for its dual-fuel burners is more expense than the district can bear on its own.

Undeterred, OEC set out to see if there might be a way to at least establish a pilot project using B20 at a school in the district, thereby providing a strong foundation for seeking funding opportunities for use of B20 district-wide. Through the course of several meetings with district officials, we were able to garner the support of the chief mechanic in charge of boiler maintenance and worked to identify a school where a pilot might be possible. Through conversations with DEQ's Air Quality division, we were able to negotiate a reduction in air permit fees PPS paid on any school participating in the B20 pilot. The money saved on the permit fees would then go toward paying the higher cost of a biodiesel blend.

Just as we were about to move forward on a pilot, a change in leadership among the mechanics left us without internal support for implementing the pilot project. Despite efforts to garner political support for the project from outside the district, we were ultimately unable to move forward with a B20 pilot project.

However, as per the sidebar, PPS did move forward with B20 in a different venue.

## Boiler Replacement

Spurred by the availability of remaining grant funds, OEC set out to help PPS fund a replacement of an oil #5 boiler with a cleaner, more efficient natural gas boiler.

The school chosen to receive these funds was Harvey Scott Elementary in Northeast Portland. This school not only utilizes dirty diesel in its boiler, but also is located in close proximity to several freight corridors, including I-205, I-5, Sandy Boulevard and NE Portland Highway. Proximity to these traffic corridors further inhibits good air quality. Harvey Scott Elementary has a high rate of free or reduced lunch participants and a large minority population.

To complete this project, OEC donated $20,000 toward the $230,000 cost of the Harvey Scott boiler replacement. The balance was paid by PPS using a combination of Senate Bill 1149 funds, Business Energy Tax Credits, and district funds.

**PPS: Thinking Outside the Box on Emissions Reductions**

As part of its effort to promote the use of biodiesel in PPS boilers, OEC developed a factsheets addressing the health effects of diesel emissions and the ease of using biodiesel blends in boilers. These factsheets, and our numerous conversations with PPS staff, proved to be the catalyst for other changes at PPS.

When the time came for PPS to renegotiate the contract with its garbage hauler, Nancy Bond, Resource Conservation Specialist for PPS, pushed for the inclusion of a biodiesel fuel usage clause. After several months of negotiations, the haulers agreed.

Waste Management of Oregon uses 10,950 gallons of fuel hauling PPS' garbage each year. The switch to a B20 blend reduces the use of diesel by almost 2,200 gallons and represents a significant reduction in diesel emissions on PPS campuses. And the company is so pleased with the results of the biodiesel usage at PPS that they are planning to expand the use of B20 to the rest of their fleet!

## Results

Boiler optimization, burner replacement, and a hydronic boiler for the annex reduces oil #5 usage by 4,486 gallons yearly. As a result of the partnership at Harvey Scott, approximately 660 pounds of SO2, 500 pounds of NOx, 100 pounds of PM, and 112 tons of CO2 annually will no longer be emitted. Benzene and formaldehyde emissions will also be reduced.

Another outcome of this partnership is energy savings. According to Catherine Diviney, PPS Energy Specialist, the project at Harvey Scott, which includes not only the main boiler conversion, but also upgrades to the school's automated energy management system and the annex heating system, should save PPS about $13,000 a year in utility costs, with a payback of about 13 years.

Although a long and evolving process, the ultimate results of this project were very positive. Working with the PPS district, OEC aided in improving air quality around a school with air quality issues and saving the district money. This successful partnership also earned media attention in the *Oregonian*.

## Lessons Learned

This outreach effort reinforced the importance of developing good relationships with potential advocates within other organizations. Initial efforts to get a pilot site within the district to use a B20 blend were only successful with buy-in from the key implementers. Staff changes that eliminated this level of buy-in from key players prevented successful implementation of the pilot project.

Sharing resources can make significant, positive changes. The availability of remaining grant funds forced OEC to creatively think about additional means for reducing stationary diesel pollution. After much consideration, OEC submitted a revised work plan to the EPA which included the use of grant funds to assist PPS with replacing an aged and heavily polluting heating system. This re-orientation allowed for a successful partnership with the PPS district and a tangible outcome in terms of improved air quality and money saved.

## Hospitals and Diesel: A Community Concern

### Profile

Portland is home to a number of medical facilities, including almost a dozen hospitals. Oregon Health & Science University, located on Marquam Hill in southwest Portland, is a complex of several hospitals; Legacy, Providence and Kaiser Permanente also maintain large campuses in Portland. In all, there are seven hospitals in the North Portland area.

Hospitals occupy a unique position in terms of air quality and health. As a mecca for people suffering from physical difficulties, including respiratory difficulties such as severe asthma attacks, it is of particular importance that hospitals work to foster the cleanest possible air in their immediate surroundings. However, the constant stream of patient vehicles, ambulances and delivery trucks makes this very challenging. Though passenger vehicles run largely on gasoline, delivery trucks and ambulances run on diesel.

As emergency facilities, all hospitals are required to maintain backup generator systems and to keep on hand enough fuel to keep them running for at least 96 hours. These generators run on diesel fuel. As backup generators, they typically only run during regular maintenance checks—less than an hour a month. Many hospitals also heat buildings using boilers outfitted with dual-fuel burners. The primary fuel is natural gas, but the boilers can run on diesel fuel in an emergency.

### Diesel Usage

OEC had some difficulty in obtaining exact figures on diesel usage; most were too small to require a DEQ permit, and identifying and contacting the person at a given hospital who would know the diesel usage figures proved challenging. Of the dozen hospitals on our inventory, we obtained diesel usage figures for four, totaling 24,526 gallons. Based on the figures we did obtain, OEC estimates approximately 30,000 gallons of diesel are used in stationary equipment at Portland hospitals on an annual basis.

### Community Concern

The Environmental Justice Action Group (EJAG) is the voice of Portland environmental justice activists. Much of their work centers on air quality in North Portland, and the elevated health risks caused by their community's overexposure to diesel emissions have made reducing diesel pollution one of the group's top priorities. Much of their work focuses on addressing pollution associated with Interstate 5, which bisects their community, but because North Portland residents report higher-than-average instances of asthma and severe asthma attacks, EJAG has been concerned about diesel emissions around hospitals.

As part of its efforts to address the diesel pollution problem in North Portland, EJAG received EPA funding to support the formation of a coalition group working on diesel issues around the city. This group, the Portland Northern Neighbors Air Quality Coalition (PNNAQC), served as an opportunity for community activists, non-profits and state agencies to learn of each others' efforts and coordinate activities, resource-sharing and events.

In February 2006, a project meant to address diesel pollution along the I-5 corridor in the Metro area, developed by EJAG with the help of the PNNAQC group, was designated as an Oregon Solutions project. Titled the North Portland Diesel Emissions Reduction Project (NPDERP), this brought even greater stakeholder involvement and support to diesel emissions reduction efforts in at-risk neighborhoods.

OEC participated regularly in the early meetings of both PNNAQC and NDERP. It was here that we learned of EJAG's long-standing concern about hospital patient exposure to high concentrations of diesel exhaust when entering or exiting a hospital building. Members of the PNNAQC group, though primarily concerned with mobile sources, were supportive of OEC's interest in cleaning up stationary diesel emissions at hospitals.

Another organization, Oregon Center for Environmental Health (OCEH), provided OEC with an opportunity to meet directly with hospital leadership. OCEH runs the Oregon chapter of Healthcare Without Harm, a national organization focused on improving the environmental performance of hospital campuses. At their invitation, early in 2005 OEC gave a presentation on the health effects of diesel emissions, with a focus on stationary sources commonly found around hospitals. Representatives from three of the four major hospital systems were present. At this meeting and at a subsequent workshop discussed in the next section, OEC distributed a factsheet we put together detailing the health impacts of diesel emissions from stationary sources at hospitals and the ease of addressing those impacts.

### A Good Idea at the Right Time: The Clean Diesel Hospital Zones

Building on EJAG's interest in diesel issues, DEQ's Kevin Downing initiated another meeting with the Healthcare Without Harm group several months after OEC's presentation. DEQ gave their own presentation on diesel, highlighting statewide goals for reducing emissions; OEC also participated briefly, highlighting the importance of stationary diesel sources in addition to the construction and mobile sources mentioned by DEQ and fielding questions on the use of biodiesel blends in all diesel equipment.

At this meeting, DEQ presented the case for OHSU to pilot a "Clean Diesel Hospital Zone." In effect, any diesel equipment operating on the OHSU campus (which is situated on top of a hill and is geographically isolated) would be required to use ULSD/biodiesel blends and/or bear retrofits. This would include public transit buses, vendor trucks, ambulances, construction machinery, and stationary diesel equipment. Though somewhat hesitant, OHSU representatives at the meeting were supportive.

Over the following months, DEQ worked to promote the Clean Diesel Hospital Zones concept among area hospitals. EPA funded a workshop designed to build commitments to action on diesel emissions among hospital leadership, in which OEC was also a participant. Out of this eventually grew an application for EPA funds to launch the Clean Diesel Hospital Zones at campuses operated by OHSU, Legacy Health System, Providence Health System, and Kaiser Hospitals.

In September of 2006, the West Coast Collaborative announced they would award a $250,000 grant to the hospitals for the Clean Diesel Hospital Zones. At a signing ceremony on October 16th, representatives from the four hospitals signed a commitment to take steps to invest in cleaner fuels and diesel technologies on their own campuses within the next year and to then take steps to reduce emissions from their suppliers, vendors and service suppliers.

"As health care providers, we recognize that prevention is often the least costly and most effective way to ensure that communities we serve remain healthy and the individuals that live there have productive lives. Declaring our campuses and facilities a Clean Diesel Zone is a further expression of our commitment to delivering quality health care to the citizens of Oregon and Southwest Washington."

*-Clean Diesel Zones Declaration of Cooperation, signed 10/16/06*

**Results**

The project is expected to reduce emissions from 51 pieces of diesel vehicles or equipment approximately 70 percent. In addition, the hospitals are using ULSD in all stationary equipment.

**Lessons Learned**

Although OEC played only a small part in the success of this project, we feel our presence was important for keeping the stationary diesel element in the final agreement signed by the hospitals. We also observed that, once again, results take time, and building relationships really does matter. In addition to these lessons already garnered from other projects:

*Collaboration gets results*. The intersection of private and non-profit, state and federal agencies, proved critical to making the Clean Diesel Hospital Zones a reality. Without the federal funding, the hospitals would not have moved forward with the program; the funding would not have come were it not for DEQ's support for the concept and the grant-writing process; and DEQ's ability to form strong relationships with hospital leadership would have been greatly slowed were it not for Health Care Without Harm's interest in the matter.

*Timing is almost everything*. The idea of Clean Diesel Hospital Zones is one whose time had come. A renewed commitment to addressing diesel from both state and federal levels served to catapult a community concern into a successful private-public partnership.

## Conclusion

Through the course of this project, OEC became very familiar with the difficulties associated with reducing diesel pollution. Even the first step, identifying stationary sources of diesel pollutions, was riddled with challenges—permit records were difficult to find and often contained incomplete information about facilities, and most stationary sources in Portland are too small to require a permit, making it virtually impossible to definitively locate them or determine how much pollution they create.

However, we were able to forge ahead with emissions reduction strategies in three markets, as required by the grant, and were a part of some modicum of success in each of those sectors. In every case, it was strong public-private partnerships that made those successes possible, and for the most part, OEC took a back seat, providing information and resources to decision-makers. We also learned that voluntary reductions alone are not an attractive proposition. The bottom line does not budge, particularly for non-profit institutions with little wiggle room in their budgets, and some seed money in the form of pass-through grants can go a long way. It could be argued that consumer education paved the way for voluntary emissions reductions in the home heating oil market, but those reductions would not have been possible if heating oil companies had not seen biodiesel blends as an opportunity to retain or gain market share.

The introduction of ULSD fuel to the Portland market, and Portland's unique status as the only city with a renewable fuel standard (minimum 5% biodiesel blended in all diesel fuel sold in the city limits) guarantees far greater reductions in Portland's diesel pollution problem than any single EPA grant could hope to create. Yet there is a great deal of work to be done before all Portland residents can breathe easy, most of it in the construction and on-road sectors. As seen elsewhere, particularly through the work of the West Coast Collaborative, the combination of regulation and public-private partnerships has the potential to create lasting solutions to regional air quality issues. OEC is glad to be a part of these lasting solutions, and to help make Oregon a clean, healthy place to live, work and play.

## Endnotes

[1] The approximations of emissions savings from the boiler replacement were based on the annual oil #5 reductions (9,260 gallons) and natural gas usage (1,478 therms) estimates provided by Portland Public Schools. To calculate the emissions from the oil #5 boiler system, Oregon Department of Environmental Quality boiler emission estimates (http://www.deq.state.or.us/aq/permit/acdp/docs/AQ-EF04.pdf) were used.
Natural gas estimates were used based on the U.S. Environmental Protection Agency's boiler emission factors (http://www.epa.gov/ttn/chief/ap42/ch01/bgdocs/b01s04.pdf). Therms were converted to standard cubic feet using the following ratios: 1 standard cubic foot= 1,000 British Thermal Units; 1 therm= 100,000 British Thermal Units. In addition, the furnace tune-ups through the Community Energy Project are expected to result in a 13% fuel use reduction in at least 50 homes, which nets a savings of roughly 4,000 gallons. Emissions reduction from hospitals were based on estimated usage of 30,000 gallons of ULSD. ULSD emissions reductions based on industry figures compiled by Kevin Downing; visit http://www.bp.com/sectiongenericarticle.do?categoryId=16002820&contentId=7017902 to access these papers. Home heating oil emissions reductions were based on an estimated 250,000 gallons of biodiesel sold annually, DEQ home heating oil emission factors, and National Oilheat Research Alliance/ Brookhaven National Laboratory estimates of B20 emissions reductions. See endnote 14 for links to this research.

[2] http://www.epa.gov/ttn/atw/nata/natsaov.html

[3] http://www.epa.gov/air/urbanair/so2/chf1.html

[4] http://www.kirotv.com/oilheat/10530495/detail.html

[5] http://www.epa.gov/air/particlepollution/health.html

[6] Industry estimates provided by Molly Brady, First Call Heating & Cooling.

[7] U.S. Environmental Protection Agency, AP 42, Fifth Edition, Volume 1, Chapter 1: External Combustion Sources

[8] U.S. Environmental Protection Agency, 2002 “A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, Draft Technical Report.” U.S. Department of Energy website www.eere.energy.gov/afdc/altfuel/biodiesel.html

[9] http://www.kirotv.com/oilheat/1873991/detail.html

[10] Energy Information Administration, U.S. Department of Energy http://www.eia.doe.gov/oiaf/1605/coefficients.html

[11] U.S. Environmental Protection Agency, (2002) “A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, Draft Technical Report.” U.S. Department of Energy website, www.eere.energy.gov/afdc/altfuel/biodiesel.html

[12] http://www.ucsusa.org/clean_vehicles/big_rig_cleanup/life-of-soot-diesel-pollution-emissions-and-health-effects.html#8

[13] http://www.cdc.gov/HealthyYouth/asthma/

[14] For technical reports and more information on biodiesel heating oil, visit http://www.biodiesel.org/markets/hom and Brookhaven National Laboratory at http://www.bnl.gov/est/erd/biofuel/bnl.asp.


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