ST. LOUIS
DIESEL EMISSION REDUCTION
PILOT PROJECT

REPORT
July 2009

Missouri Department of Natural Resources

BLUE SKYWAYS COLLABORATIVE

GRACE HILL Neighbors Helping Neighbors Since 1991 Clean Air Project

SmartWay Transport Partnership U.S. Environmental Protection Agency

ST. LOUIS DIESEL EMISSION REDUCTION PILOT PROJECT

REPORT July 2009

Subaward between Central States Air Resources Agencies Association (CenSARA) and Missouri Department of Natural Resources (DNR)
Subaward Number: 07-1009-BSC-003

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Acknowledgements

Thanks to the following organizations for their support and guidance:

Environmental Protection Agency Regions 6 & 7 / Blue Skyways Collaborative

EPA Office of Transportation & Air Quality

Central States Air Resources Agencies

St. Louis Community Air Program / Saint Louis Association of Community Organizations

East-West Gateway Council of Governments

Anheuser-Busch

St. Louis Regional Asthma Consortium

Lohr Distributing

St. Louis Regional Clean Cities

Kansas State University / Pollution Prevention Institute

American Lung Association of the Central States

Caterpillar / Fabick CAT

Cummins

Donaldson

Truck Centers

Wedge Tire Co.

Eaton

Engine Control Systems

City of St. Louis / Mayor's Office

City of St. Louis / Board of Aldermen

City of St. Louis / Streets Division

Fred Weber

M & L Foods

Tocco Frozen Foods

Rendon Trucking

Owner-Operator Independent Drivers Association

Executive Summary

Reducing diesel emissions from freight transport across the United States and in congested metropolitan areas is essential to achieve healthy air quality. The St. Louis Diesel Emission Reduction Pilot Project was a collaborative effort launched by the Missouri DNR Air Pollution Control Program (APCP) and the Grace Hill Clean Air Program (CAP) to test run and evaluate the effectiveness of the EPA's SmartWay program to achieve diesel emission reductions through voluntary measures. The pilot project recruited five trucking operations to install SmartWay diesel retrofit equipment, adopt idle reduction strategies, and obtain their feedback.

A St. Louis Diesel Retrofit Workshop was held at the Anheuser-Busch Visitor Center to recruit the five trucking fleets, and inform the wider trucking community about the EPA's SmartWay program. Trucking fleet managers expressed interest in the environmental and technical information presented by Missouri DNR, Grace Hill, and the EPA-verified diesel equipment manufacturers. The trucking community is amenable to working with air quality staff to reduce their costs and diesel emissions, by improving their vehicle performance and fuel efficiency. Diesel fuel price fluctuations and the economic downturn were decisive factors in the types of diesel retrofit equipment that were selected by the trucking fleet managers and independent owner operators that participated in the pilot project.

St. Louis was found to be the worst city in the U.S. for asthma in 2009, where childhood asthma rates are almost three times the national average. Urban neighborhoods adjacent to industrial areas and interstates are heavily traversed by both in town and long haul of trucks. A mix of highway, industrial, commercial, and municipal trucking operations were recruited for the pilot project in order to obtain a broad overview of practical experiences with the SmartWay approach. A number of strategies and technologies are effective in reducing emissions for both in-town and over the road trucks.

The Owner-Operator Independent Drivers Association (OOIDA) attended the workshop, and subsequently hosted a follow-up workshop at OOIDA headquarters in Grain Valley, Missouri, to follow up on freight transport and air quality issues of mutual concern. Trucking is a highly competitive industry with no time and money to waste. They are not strictly opposed to regulations for idling and emission standards as long as they are uniform nationwide, technical assistance is available, and financial hardships are not imposed. A wide range of ideas was produced that builds upon the EPA SmartWay program to achieve further reductions in diesel emissions and improve the efficiency of freight transport across the Blue Skyways central states region. This initial collaboration needs further support and development.

Fuel savings and emission reductions achieved by the installation of the diesel multi-stage filter (DMF) and diesel oxidation catalysts (DOS) were estimated employing two methods, the EPA Diesel Emission Quantifier (DEQ), and a fuel-based method (FBM). Agreement between the two methods varied. The fuel savings due to the installation of the low rolling resistance tires, designation of No-Idling Zones, and idle reduction practices are each expected to be a few to several percent, but this and the reductions in diesel PM and NOx emissions achieved by the increase in fuel efficiency could not be documented.

The trucking industry needs technical assistance to identify the most appropriate diesel retrofit strategies and technologies. This might take a form of an energy audit, expanding the green sector of the economy. Fleets of one to six diesel trucks are the oldest and worst emitters, most numerous, most difficult to contact, and in greatest need of technical assistance and funding. Dedicated technical staff are needed to develop inventories of diesel vehicles and their emissions, coordinate with the freight transport industry, and prioritize the largest sources of diesel emissions. Funding is needed for diesel retrofit equipment and replacement vehicles to take the worst emitting trucks off the road.

I Introduction

The Saint Louis industrialized regions spanned by interstates I-70, I-64, I-44, I-55, and the Mississippi riverfront are bustling with diesel-powered truck, train, and river barge traffic. A major concerted diesel emissions reduction program is needed to address the heavy-duty diesel emission sources of particulate matter ($PM_{2.5}$ and PM_{10}), SOx, NOx, VOC, and HAP that impact throughout the Ozone and PM2.5 Nonattainment Area.[1] The U.S. EPA's SmartWay Transport Partnership promotes a range of control strategies and technologies to reduce emissions and fuel consumption costs associated with the existing ground freight transportation infrastructure. Controls include emission filters, improved aerodynamics, idle reduction technologies, and driver training.

This introduces a new role for the Missouri Department of Natural Resources, which does not regulate diesel emissions from industrial and commercial mobile sources. Federal EPA emission standards require over 90 percent reductions in 2007 and newer onroad diesel truck engines, and 80 - 90 percent emission reductions are being phased in for nonroad construction, industrial, and agricultural vehicles, locomotives, and marine vessels. However, these new standards do not apply to existing older heavy duty diesel vehicles which pollute at much higher rates. Many of which will remain in service for another 10 to 30 years.

Missouri DNR is a member of the Blue Skyways Collaborative (BSC), one of seven regional U.S. collaboratives established by the EPA to promote voluntary diesel emission reduction projects. It is led by EPA Regions 6 & 7 and coordinated by the Central States Air Resource Agencies (CenSARA), with ten member states, Clean Cities, regional and community organizations, trucking companies, industries, and trade associations. This pilot project is the outgrowth of MDNR participation on the Blue Skyways Collaborative since its inception in 2005. It represents the first action taken by Missouri DNR to address diesel emissions from mobiles sources. *The St. Louis Diesel Retrofit Program* website is posted online.[2]

The St. Louis Diesel Emission Reduction Pilot Project was funded by the EPA through a Blue Skyways Collaborative grant awarded in October 2007, and administered by CenSARA. Federal funding through the Diesel Emission Reduction Act (DERA) expanded from about $5 million nationally in 2007 to $50 million in 2008. To this has been added $300 million of American Recovery & Reinvestment Act (ARRA) stimulus funding for diesel emission reductions, for a combined total of $350 million in ARRA and DERA national funding for 2009. These funds will be awarded by EPA for investment in clean, efficient diesel technologies.

Project Partners

The pilot project was a collaboration between the Missouri DNR Air Pollution Control Program (APCP), Grace Hill Clean Air Program (CAP), and five St. Louis-based public, private, commercial, industrial, and independently owned and operated trucking fleet operations: The City of St. Louis Street Division, Tocco Foods, M & L Foods, Fred Weber, and Rendon Trucking.

Many people in St. Louis, the EPA, and the APCP have contributed to this project. Initial backing and recommendations came from the St. Louis Community Air Project (CAP). This pioneering community-based project conducted air toxics monitoring, emission inventory, and health risk assessment activities. The St. Louis CAP laid the groundwork for future community involvement in air quality projects.[3, 4, 5]

Anheuser-Busch generously donated the use of the meeting space at their Visitor Center for the St. Louis Diesel Retrofit Workshop. EPA-verified diesel retrofit equipment, prices, and technical presentations at the workshop were provided by Caterpillar, Cummins, Donaldson, Eaton, and Engine Control Systems. Diesel retrofit equipment selected by the fleet managers and environmental engineers at the participating pilot project companies was installed by Wedge Tires and Truck Centers of St. Louis.

Pilot project activities were conducted in the St. Louis area by the Grace Hill Clean Air Program (CAP). Grace Hill is a community organization that provides a wide range of services in the City of St. Louis. Previously Grace Hill developed and led a successful campaign to eliminate diesel engine idling by school buses throughout the City of St. Louis Public Schools. One of the notable successes of this pilot project is that it has led to Grace Hill assuming a leadership role in carrying out expanded diesel emission reduction projects in the City of St. Louis.

Diesel Health Effects

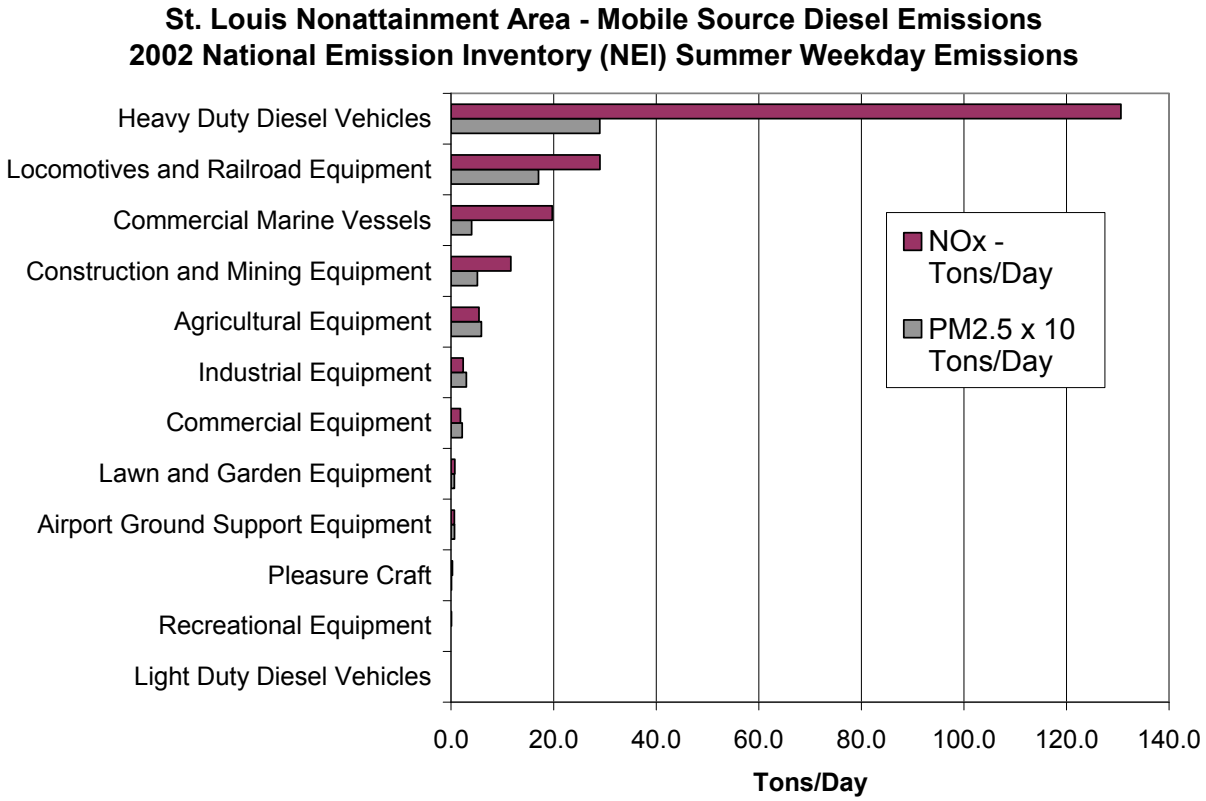
Diesel exhaust causes lung cancer, cardiovascular diseases, and other serious health problems. The lifetime cancer risk from diesel particulate matter (diesel PM) has been found to exceed the risks from all other hazardous air pollutants (HAPs) combined. Diesel fumes from older trucks cut short the lives of more than 20,000 Americans each year, according to a report by the Clean Air Task Force.[6] Nationwide, diesel exhaust causes almost 3,000 early deaths from lung cancer. Diesel pollution causes some 27,000 non-fatal heart attacks and 410,000 cases of asthma each year. Health damages from diesel exhaust will total some $139 billion by 2010. The majority of these deaths and diseases could be avoided by applying currently available diesel retrofit control technologies.

St. Louis ranks as the worst city in the United States for asthma for 2009, by the Asthma and Allergy Foundation of America.[7] In inner-city areas of St. Louis the rate of asthma in children is almost three times the national average. Air pollution is a known factor influencing the development and expression of asthma. Studies show the closer children live to a freeway, the greater their chances of having asthma. Air pollution levels of particulates, ozone, SO_2 and NO_2, have been shown to trigger symptoms of asthma and to increase hospitalizations. Through truck traffic on residential streets discharges diesel exhaust from raised exhaust pipes directly at the level of open windows in homes along these streets. Long haul trucks park overnight in these neighborhoods and idle their engines to run the heaters or air conditioners. Children living in inner cities are exposed to a disproportionate quantity of air pollution, and suffer with serious chronic respiratory health problems such as asthma as a consequence.

The health effects of diesel exhaust are also a serious concern to the trucking industry. The average life expectancy of truck drivers is in the late 50's, far below that of the average American. Most of these truckers carry no health insurance. A 2005 National Institute of Safety and Health (NIOSH) study found the highest significantly elevated rate of heart disease, heart attacks, and lung cancer mortality for long haul truck drivers age 15-54.[8] Conversely based on 30,000 workers' records, researchers from Harvard University and the University of California in Berkeley found that short-haul drivers are exposed to more exhaust than long-haul drivers.[9, 10] Whether short or long haul truck drivers are more at risk from diesel emission exposure, urban areas are subject to both types heavy diesel truck traffic in appreciable amounts. Current diesel truck and emission inventories do not distinguish between the two. One goal of this pilot project was to include both in-town and over the road trucks to evaluate the capacity of selected SmartWay technologies and strategies to reduce their emissions.

Diesel Emission Inventory

The 2002 National Emission Inventory (NEI) of PM2.5 and NOx emissions from diesel motor vehicles in the St. Louis Ozone and PM 2.5 Nonattainment Area in Missouri and Illinois is shown below. This data indicates that onroad heavy-duty diesel trucks are the principal mobile source of diesel PM2.5 and NOx emissions in the St. Louis area. This is the first diesel emission inventory to have been completed on a national basis, as well as for the St. Louis area. An updated Missouri and/or St. Louis area specific inventory is needed to more accurately quantify the numbers and ages of trucks in fleets in the St. Louis area, as well as their diesel emissions, appropriate diesel retrofit technology, and company contact information.



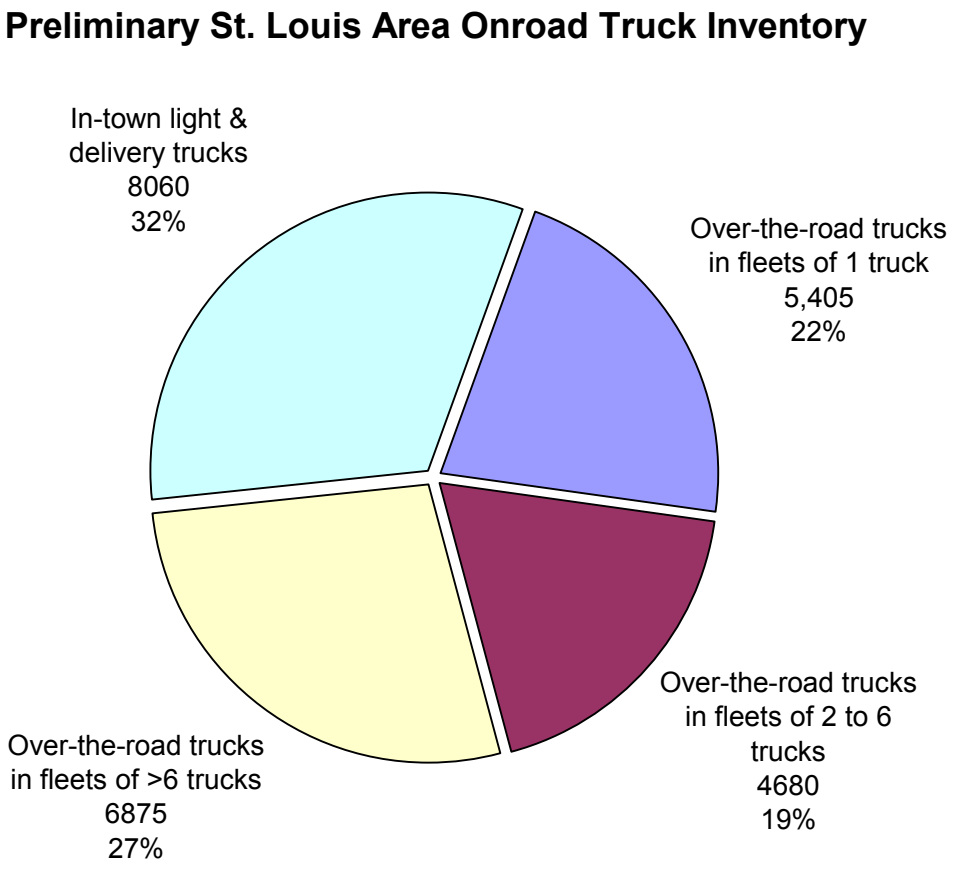
The scale of diesel trucking transport operations throughout the St. Louis metropolitan area, across Missouri, and in the U.S. is indicated by Bureau of Labor Statistics data. There are about 25,000 industrial and commercial truck drivers based in the St. Louis region, in addition to the thousands of trucks passing through St. Louis from all parts the country.

Truck Drivers in St. Louis, Missouri, and the U.S.:

	Heavy Tractor Trailers	Light or Delivery Trucks	TOTAL
St. Louis MPO:	16,960	8,060	25,020
Missouri:	44,550	15,420	59,970
United States:	1,693,590	922,900	2,616,490

Bureau of Labor statistics Data for 2007[11]

Combining these statistics with the OOIDA information that small business fleets of six heavy tractor trailers or less comprise 96% of all the long haul trucking businesses on the road, while 50% of all long haul fleets consist of one truck, gives this preliminary St. Louis metropolitan area onroad diesel truck fleet inventory. It assumes 16,090 over-the-road trucks and 8,060 in-town trucks or a total of 25,020 trucks are based in the St. Louis area.



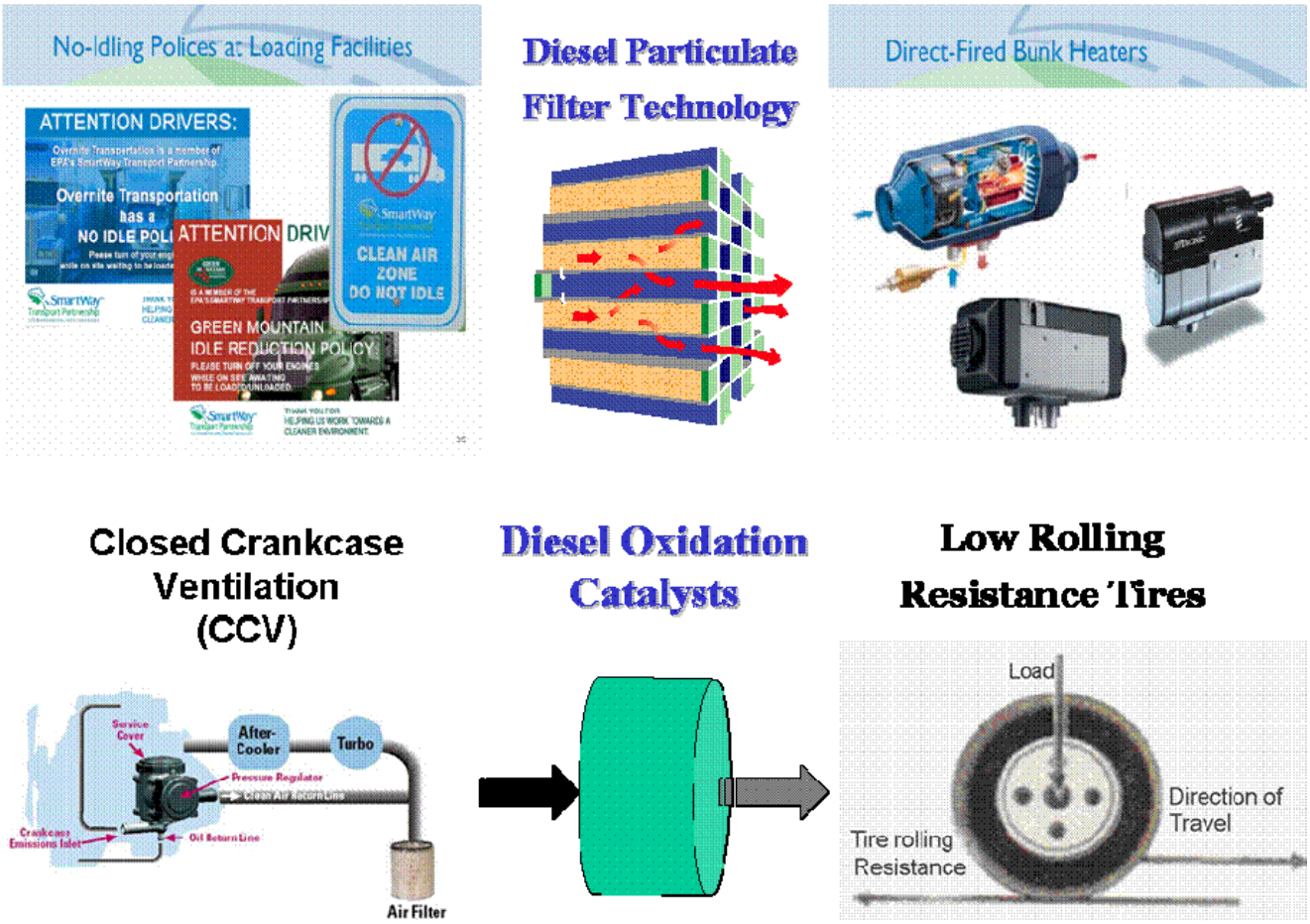
Current numbers are likely to differ due to recent fluctuations in diesel fuel prices and the economy. An updated inventory would provide a better indicator of priorities for diesel retrofit funding and outreach, particularly when compiled with an inventory of the ages and emissions of diesel vehicles. Inputs to such an inventory could include attendees to the pilot project and future diesel retrofit workshops.

A difficulty encountered in having representative attendance at the workshop was in locating managers of smaller trucking fleets and independent owners and drivers. The assistance of OOIDA in making contact with a number of these small business owners led to the recruitment of one over the road driver for the pilot project. More concerted efforts are needed as smaller fleets often have the oldest trucks, which are most in need of retrofit equipment, technical assistance, and funding. They are also the most difficult to reach out to, since they are out on the road and busy contending with fuel prices and other economic realities on a daily basis.

SmartWay Diesel Emission Reduction Strategies

The EPA developed the SmartWay Transport Partnership for the freight transport industry to increase fuel economy and reduce emissions by retrofitting pre-2007 trucks with one or more pieces of diesel emission reduction equipment. Retrofit equipment for both in-town and over-the road fleets includes emission filters such as diesel particulate filters (DPFs), partial DPFs, also called diesel multi-stage filters (DMFs), and diesel oxidation catalysts (DOCs). Idle reduction equipment includes the direct-fired bunk heater, and low rolling resistance tires. Both in-town and over-the road trucks can increase fuel economy and emission reductions by designating no-idling zones, adapting idle-reduction strategies, and installing the equipment shown below.

SmartWay Retrofit Equipment & Strategies
Effective on both In-Town and Over-the-Road Trucks



Additional SmartWay equipment for long haul trucks includes aerodynamic streamlining attachments for the cab and van, auxiliary power units (APUs), and battery-operated air conditioners (BACs). A useful explanation of the roles of aerodynamics, low rolling resistance tires, idle reduction practices, and driving efficiency in improving engine performance and fuel efficiency is given by AER.[12] Both in-town and over-the-road trucking operations were recruited for this pilot project in order to obtain a broad overview of practical experiences with SmartWay technologies and strategies.

Installed together, one or more pieces of diesel retrofit equipment are called a SmartWay Package or Upgrade Kit. EPA designed the SmartWay packages to pay for themselves in terms of fuel savings**.** Combined with no-idling zones and policies, installing a complete SmartWay package can reduce diesel PM emissions by over 90%. At the same time they will achieve fuel cost savings of up to 25 percent, and an equivalent reduction in greenhouse gas emissions. Online SmartWay calculators show monthly fuel savings more than cover monthly payments for various possible SmartWay packages.

SmartWay Retrofits, Packages, Prices, and Fuel Savings									
				Monthly Loan					
TECHNOLOGY	Cost	Cost to Trucker	Fuel Saving Per Mo	Payment @ 9% For 48 Months	Net Monthly Savings	% Fuel Save	Emission Reductions PM	HC	CO
Idle Reduction Device -									
- Bunk Heater	$1,500	$1,500	$215	$37	$178	5%	5%	5%	5%
- Auxiliary Power Unit (APU)	8,500	8,500	330	212	118	8%	8%	8%	8%
Increase Fuel Efficiency									
Aluminum Wheels / Single Wide Tires	5,600	5,600	153	139	14	4%	4%	4%	4%
Trailer Aerodynamics	2,400	2,400	191	60	131	5%	5%	5%	5%
Exhaust Aftertreatment Device -									
-Diesel Oxidation Catalyst	1,200	1,200	0	30	-	-	20%	50%	40%
-Particulate Matter (PM) Filter	6,000	0	0	149	-	-	90%	60%	60%
SAMPLE PACKAGES									
1. PM Filter, DOC, Heater, Aero	$11,100	$5,100	$406	$127	$279	10%	92.0%	65.0%	64.0%
2. PM Filter, DOC, APU, Aero	18,100	$12,100	521	421	$100	13%	92.6%	66.5%	65.2%
3. PM Filter, DOC, Heater, Tires, Aero	16,700	$10,700	$559	$266	$293	14%	92.8%	67.0%	65.6%
4. PM Filter, DOC, APU, Tires, Aero	$23,700	$17,700	674	441	$233	17%	93.4%	68.5%	66.8%

Practical limitations arise when fleet managers are making retrofit selections based on their bottom line. Diesel particulate filters with their high cost may be eliminated from consideration since they do not pay for themselves in terms of fuel savings. Retrofit investments must be balanced with the cost of fuel, emission reductions, and health benefits.

Financing Considerations

The logic behind the decision not to provide state financing (other than the grant funding) was to keep things simple as far as state resources are concerned. This also served as a test to see if project participants would seek and be able to obtain financing on their own. At project proposal time in 2007, financing for sound business investments was readily available. By summer 2008 when the pilot project was in full swing, skyrocketing fuel prices and the uncertain economy rendered most new financial ventures out of the question. Project participants nevertheless applied for the funding available for diesel retrofit equipment, and made full use of it. Fleet managers and drivers clearly regard reducing diesel emissions and improving fuel economy as worthwhile investments of their time and energy.

II. Diesel Pilot Project

Pilot Project Objectives

The objective of this study was to demonstrate the diesel emission reductions achievable by the voluntary adoption of the EPA SmartWay approved diesel retrofit technologies and control strategies. This pilot project recruited five trucking operations to put the SmartWay program through its paces and obtain their feedback. It explored the level of support and kinds of technology trucking firms are actually willing to install, and the technical assistance and funding they require, in order to maximize diesel emission reductions by the voluntary adoption of the EPA SmartWay program.

If a pilot program proves successful in reducing diesel emissions on a small scale, one outcome may be to develop a diesel emission reduction program for control strategies. The department's Air Pollution Control Program could recommend a large-scale diesel retrofit program as one of the SIP contingency measures. A full-scale regulatory program based upon the EPA SmartWay Transport control measures could achieve major reductions in diesel particulate matter ($PM_{2.5}$), NOx, VOC, and HAP emissions. Added benefits include increased fuel efficiency with fuel cost savings of up to 40 percent, and an equivalent reduction in greenhouse gas emissions. This will require the introduction of advanced new engine technology, such as hydraulic hybrids for delivery and refuse trucks, and buses.

Pilot Project Description

The pilot project was designed to test run key components of a diesel emission reduction program. The program would recruit, provide technical information and assistance to, and reimburse five trucking firms for their installation of SmartWay packages. For the pilot it was required that the SmartWay package include either a diesel oxidation catalyst (DOC) or a diesel particulate filter (DPF), since these are important from an air quality, but not fuel efficiency or cost savings standpoint. Key components of the diesel emission reduction pilot project were carried out as follows, and as provided in the Grace Hill Workplan (Attachment C):

- A St. Louis Diesel Retrofit Workshop was held to inform industrial, municipal, and trucking company fleet managers, environmental engineers, and independent owner-operator truck drivers. Pilot project participants were recruited at the workshop.
- Pilot project participants selected and retrofitted one or more pre-2007 trucks in their fleet with EPA-verified SmartWay diesel retrofit equipment, which included at least one diesel particulate filter (DPF) or diesel oxidation catalyst (DOC). Through this grant, MDNR and Grace Hill reimbursed each participant up to $4,500 for their purchase of either a DPF or DOC and additional optional diesel retrofit equipment.
- This project also provided instruction on idle reduction practices at the workshop, and funded the designation of No-Idling zones.
- Diesel emission reductions achieved by the retrofit equipment installations and idle reduction measures were calculated based on the mileage and fuel usage documented by project participants, applying the specified emission reductions of the DPFs and DOCs.
- Participant feedback and emissions reductions were used to evaluate the effectiveness of SmartWay voluntary measures to achieve needed reductions in diesel emissions.

1. St. Louis Diesel Retrofit Workshop

The purpose of the workshop was twofold, to recruit five participants for the pilot project, and to engage the wider trucking community in an introduction to SmartWay diesel retrofit and air quality issues of mutual concern. The mechanics of putting on a workshop involve a considerable number of planning, publicity, contacting, and coordination activities.

The workshop was held virtually at no cost to the grant. Anheuser-Busch generously donated the use of the beautiful meeting space at their Visitor Center. Technical presentations were provided by the EPA-verified diesel retrofit manufacturers. Distinguished panel members were invited from the EPA/Blue Skyways Collaborative, city, state, industry, and health organizations.

As a member of the SmartWay Transport Partnership, Anheuser-Busch has implemented a number of SmartWay control equipment and strategies.

MEETING SPACE – An appealing central location was selected at the Anheuser-Busch Brewery Visitor Center in downtown St. Louis. They provided not only the space, but also the staff, furnishings, A/V equipment, and refreshments. A fully outfitted eighteen-wheeler Budweiser truck was parked outside the windows, demonstrating the latest SmartWay diesel emission reduction equipment.

WORKSHOP FLYER – Public announcement of the St. Louis Diesel Retrofit Workshop & Expo was made with the posting of this flyer on a new website designed by DNR (Attachment D). Registrations could be made online.

PUBLICITY – Publicity was also provided by business journals and national online trucking publications. The St. Louis Business Journal, East-West Gateway Newsletter, Drive 18 Wheeler, and the Owner-Operator Independent Drivers Association, OOIDA Land Line Magazine featured informative articles announcing the upcoming workshop. (Attachment E)

TURNOUT – On Blue Skyways conference calls, states planning workshops have asked how this workshop succeeded in having such a good turnout. A week and a half before the event, there were only about a dozen or so people registered. Several APCP staff members then invested a few days calling every trucking fleet and industry in the St. Louis area for whom contact information could be located, signing them up for the workshop. E-mail confirmations were sent to everyone who registered. This worked well, although it was labor intensive. We registered and had a turnout of about 60 attendees.

WORKSHOP AGENDA – At the workshop Grace Hill and DNR gave an overview of the EPA SmartWay diesel emission reduction concepts, and talked about the new state Idle-Reduction Rule. Grace Hill provided perspectives of parents and children living with respiratory and other health problems in the City of St. Louis. (Attachment F)

TECHNICAL TALKS – Five of the nation's foremost diesel equipment companies gave presentations; Caterpillar, Cummins, Donaldson, and Engine Control Systems presented the latest EPA-verified diesel retrofit equipment. Eaton provided an overview of hydraulic hybrid technology for buses, refuse, and delivery trucks. Each of these companies had displays around the perimeter of the room for fleet managers to meet with their representatives and make arrangements to have SmartWay packages installed on vehicles in their fleet.

PANEL DISCUSSION – The panelist discussion shared perspectives on the impacts of diesel emissions on air quality, health effects, and the significance of diesel emission reduction strategies. Panelists were from Missouri DNR, the City of St. Louis, American Lung Association of the Central States, St. Louis Regional Asthma Consortium, East-West Gateway Council of Governments, St. Louis Regional Clean Cities, Anheuser-Busch, and Lohr Distributing. The 2008 Diesel Emissions Reduction Act (DERA) funding was explained by EPA Region 7 - Blue Skyways Collaborative. Panel participation was important to begin to build the awareness, support and involvement that will be required to carry out an effective diesel emission reduction program in the St. Louis area.

2. SmartWay Package Installation

For trucking fleet managers and environmental engineers looking for ways to save on their freight transportation business expenses, SmartWay offers a wide variety of opportunities. SmartWay technologies and practices can help truck carriers save fuel and money, reduce air pollution, and cut carbon dioxide emissions that contribute to climate change. An excellent introduction to the topic is the Chrome Shop Mafia 4-minute video that sums up the over-the road SmartWay strategies.[13]

Through this grant, DNR reimbursed the five project participants up to $4,500 for the purchase and installation of a SmartWay package on one or more pre-2007 trucks in their fleet, as shown on the Pilot Project Application (Attachment I). The purchase requirements and options were:

- The $4,500 must be used to purchase and install at least one diesel particulate filter (DPF) or diesel oxidation catalyst (DOC) on one or more pre-2007 trucks. This should cover much of the cost of the diesel filters that reduce diesel emissions by 20 to 90 percent, but do not reduce diesel fuel costs.

Remaining funds may be used to purchase and install additional equipment such as:

- A closed crankcase ventilation system (CCV) and/or NOx engine reflash adjustment.
- One or more DOCs, CCVs, and NOx engine reflash adjustments for additional vehicles.
- Auxiliary power unit (APU) or other idle reduction equipment such as bunk heater or battery-powered air conditioner.
- Super single or dual low rolling resistance tires.

Grace Hill worked closely with prospective project participants on their applications to assist them in the selection of the vehicle(s) in their fleet, and the most appropriate retrofit equipment. EPA-verified diesel retrofit equipment companies and installers in St. Louis, with price range estimates for retrofit equipment, were compiled for ready reference (Attachment K). St. Louis diesel retrofit installers were contacted and

working arrangements were established. Reimbursements were made for each retrofitted truck after installation of all the equipment was made and verified by Grace Hill, and the receipts were submitted to Missouri DNR.

3. Idle Reduction Zones & Practices

Establishing idle reduction zones requires very little in terms of financial investment, yet is one of the most effective means to achieving both considerable diesel emission reductions, and increasing fuel efficiency and cost savings. It is therefore a key component of the SmartWay information that was presented at the workshop to St. Louis truckers and businesses, who are looking at how they can reduce emissions and save on rising fuel costs.

Pilot project participants agreed to establish No-Idling Zones, and allow instruction to be provided to their drivers on adapting idle reduction strategies at their facility. The project funded the establishment of No-Idling zones, which were designated by No-Idling signs provided by Grace Hill Clean Air Program (CAP). Instructions on idle reduction practices to be presented to the participating companies were developed and discussed by Missouri DNR and Grace Hill CAP.

4. Fuel Savings & Emission Reductions

In the pilot project proposal, diesel emission reductions for the installation of five SmartWay Packages consisting of a DPF, DOC, APU, and aerodynamic attachments, were estimated based on average EPA estimates:

Annually, five (5) class 8 heavy duty diesel trucks travel:
100,000 miles per year / 6 mpg average = 16,667 gallons of diesel x 5 trucks =
83,335 gallons of diesel per year

These five trucks emit:
60 Lb Diesel PM + 3,500 Lb NOx x 5 trucks = 300 Lb PM + 17,500 Lb NOx

FUEL SAVINGS & DIESEL EMISSION REDUCTIONS TO BE ACHIEVED:

5 SmartWay #2 packages:
13% Annual Fuel Savings = 2,167 gallons of diesel
Emission Reductions = 278 Lb Diesel PM + 2,275 Lb NOx

Actual fuel savings and emission reductions achieved by the retrofit equipment installations and idle reduction measures were calculated using a fuel-based method and DOC or DPF specifications, and fuel consumption before and after installation of the retrofit equipment. Companies routinely track their vehicle miles traveled and fuel consumption, this data was utilized for this purpose. Emission reductions were also estimated by entering the diesel fleet and retrofit equipment information into the EPA Diesel Emission Quantifier, and these results were compared to the fuel-based calculations.

III. Project Results

The scope of the pilot project provided an effective portal into the world of freight transport and diesel emission reduction strategies. The welcome reception at the St. Louis Diesel Retrofit Workshop confirmed that the EPA's SmartWay program was viewed to be of benefit by the trucking industry. Interest was heightened by the skyrocketing fuel costs taking place in the spring and summer of 2008, generating a volatile business climate that appears to be ongoing for the foreseeable future. Recruiting and working with the pilot project participants, diesel retrofit equipment manufacturers, and St. Louis-based retrofit equipment installers, was labor intensive but necessary to select and install the right retrofit equipment.

• St. Louis Diesel Retrofit Workshop - Outcomes & Findings

- Sixty trucking representatives attended and showed great interest and appreciation for the SmartWay diesel retrofit equipment, health, energy, and environmental material presented. They rated the workshop very highly (Attachment H).
- Education and outreach is important in order to reach the trucking community, who expressed a readiness to engage in future discussions and collaborative projects.
- A representative of the Owner-Operator Independent Drivers Association attended, and provided a number of valuable comments. A few months later OOIDA hosted a meeting at their headquarters in Grain Valley to continue the discussion of freight transportation and air quality issues of mutual concern.[16, 17, 18]
- One difficulty encountered by the workshop was in reaching smaller fleets of trucks including independent over the road truck owners and drivers. They are the most difficult to locate and contact, since they are on the road and busy contending with stiff competition, fluctuating fuel prices and other economic realities on a constant basis.
- The assistance of OOIDA in contacting a number of these small business owners made possible the recruitment of an independent over the road driver for the pilot project.
- Smaller fleets, including fleets of one, often have the oldest trucks, which have the highest emissions. Concerted efforts to contact and assist small and one truck fleet owner operators are needed as they are most in need of diesel retrofit equipment or vehicle replacement, technical assistance, and funding.
- Ten attendees signed up for more information about the Pilot Project. (Attachment G)

• Project Participants & Diesel Retrofits

Five pilot project participants were selected from across the spectrum of trucking operations: the City of St. Louis Streets Division, which has a public fleet of over a hundred diesel powered vehicles of various makes; Fred Weber, St. Louis area's industry leader in heavy and highway construction, Tocco Foods and M&L Frozen Foods, specialty foods distribution companies that have served the St. Louis area for generations, and an independent over the road trucking business, owned and operated by Gustavo and Sheila Rendon.

- **St. Louis-Based Installers of Diesel Retrofit Equipment**

We requested and compiled the EPA-verified diesel retrofit equipment purchase options, price range estimates, suppliers and installers in the St. Louis area, and provided it to the project participants (Attachment J). It was up to the participants to select the equipment and installers for which the grant would reimburse them. Grace Hill provided extensive technical assistance to each of the five participants in reviewing the fleet characteristics and needs, and selecting the most effective retrofit equipment. Given five participants each with approximately five purchase options, times the number of St. Louis-based supplier/installers (also five, including International who was contacted for possible equipment purchases), it was a time consuming process. Two St. Louis companies installed the equipment; Truck Centers did the DOC and DMF installations, and Wedge Tires installed the low rolling resistance tires.

We were fortunate to learn from the experiences of the Blue Skyways Collaborative / Onroad Subcommittee conference callers, who reported that malfunctions and project setbacks would occur if the wrong equipment was installed. Truck Centers was careful to make accurate measurements and specifications so that the right equipment was ordered, assembled, and installed the first time. Wedge Tires installed three sets of six low-rolling resistance tires on participating trucks. The equipment selections and installations that were made were as follows:

Diesel Retrofit Equipment Installed on Project Participants' Trucks

Company Name	Vehicle Type	Retrofit Equipment
Rendon Trucking	1998 Freightliner	1 DOC, 6 Low Rolling Resistance Tires
St. Louis City Street Division	Three - 2003 International 7400 Crew Cabs	3 DOCs
Fred Weber	One - 2005 Mack AI350-Vmack Refuse Hauler	1 Diesel Multi-Stage Filter (DMF)
Tocco Frozen Foods	Two - 2001 or 2002 Refrigerated Freightliners	2 DOCs, 6 Low Rolling Resistance Tires
M & L Foods	Two - 2001 or 2002 Refrigerated Freightliners	2 DOCs, 6 Low Rolling Resistance Tires

Low Rolling Resistance Tires for In Town Trucks

EPA has approved low rolling resistance single wide and dual tires for over the road applications. In the pilot project, the application of this technology for in town trucks was also allowed. "At a steady speed of 65 miles per hour on a flat road, aerodynamic drag and rolling resistance account for 21 percent and 13 percent, respectively, of the total energy used by a class 8 heavy-duty tractor trailer. At lower speeds, rolling resistance assumes a greater fraction of the vehicle's power requirements."[19]

- **Idle Reduction Zones & Driver Training**

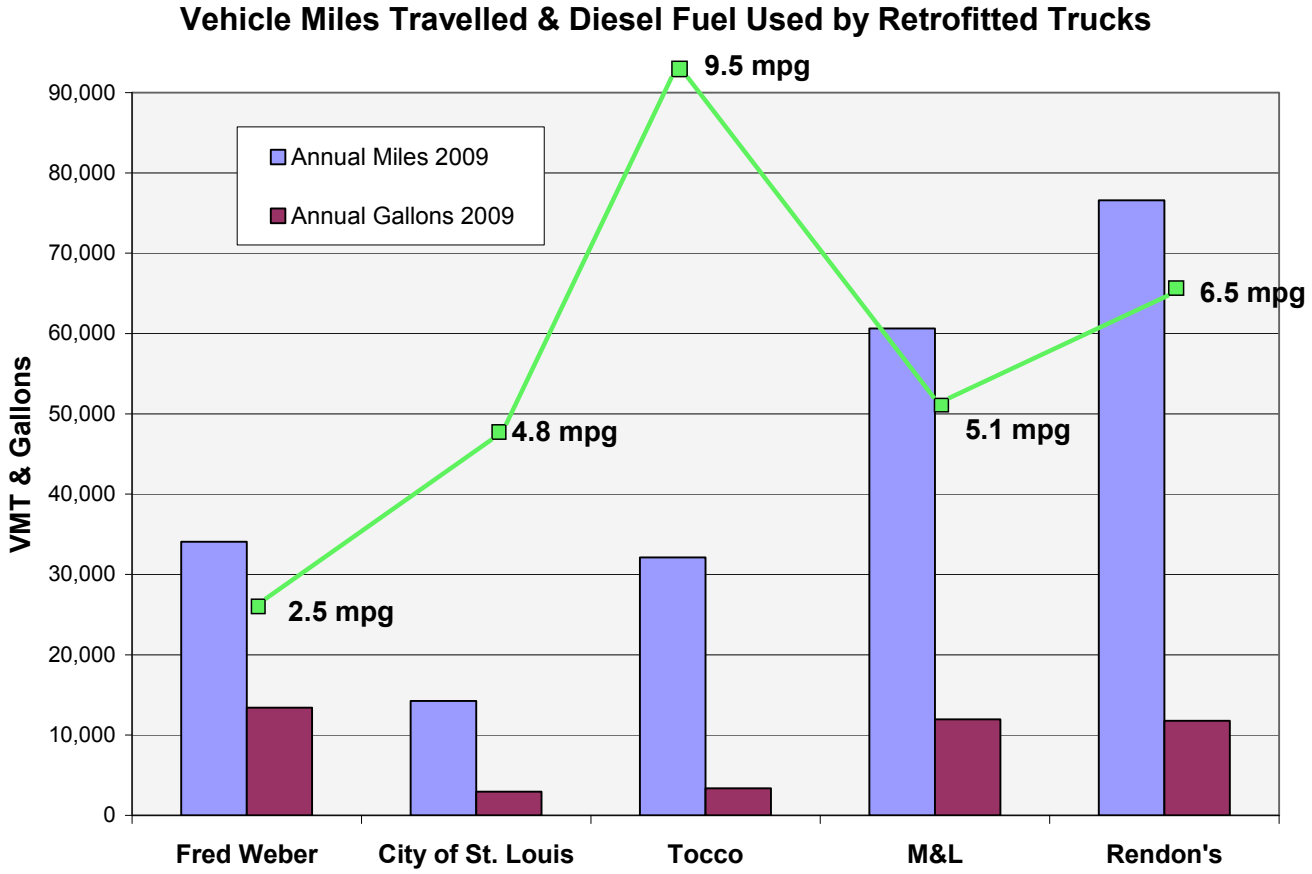
No-Idling Zone signs were manufactured by the City of St. Louis Streets Division sign shop, the same quality construction as the city street signs. Grace Hill and the City of St. Louis pooled available resources to have a number of additional No-Idling signs produced and posted for participating companies and at various truck loading zones throughout the city. Project participants posted several signs at each of their businesses, and all were pleased with the reduction in diesel exhaust fumes. Since the Rendon's over-the-road truck does not have a fixed loading zone, they posted their No-Idling Zone sign directly on the truck.

Truck Driver Idle Reduction Education

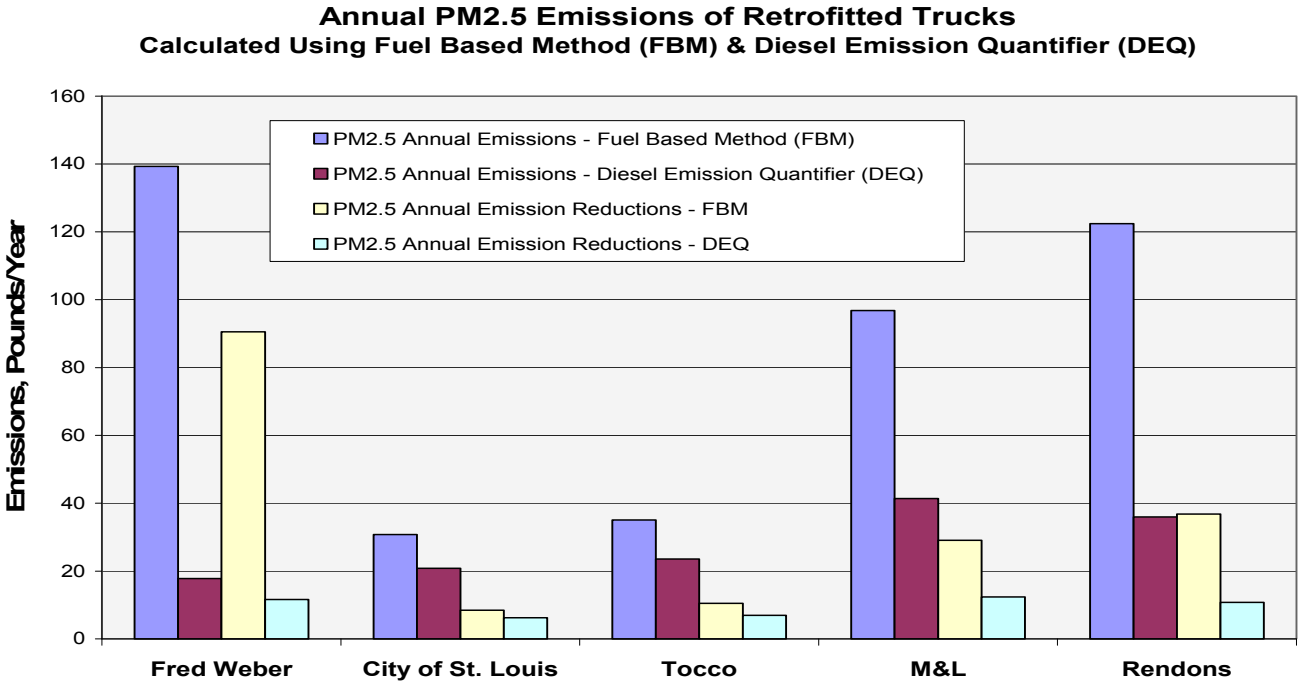
Driving techniques and practices have a considerable effect on fuel efficiency. The driver has direct control over numerous factors that affect vehicle performance, primarily vehicle speed, acceleration, engine speed, and idling time. A power point presentation was given to the project participants that discusses the health hazards of idling, idling myths, and the new idling ordinance for St. Louis County and City.[20, 21] Information on DOC and DPF filters and other types of retrofit equipment, a description of the SmartWay program, and Blue Skyways Collaborative – EPA Region 7 contact information is included in the presentation. The impact and value of diesel emission reductions in terms of health and community is discussed.

- **Fuel Savings & Emission Reductions**

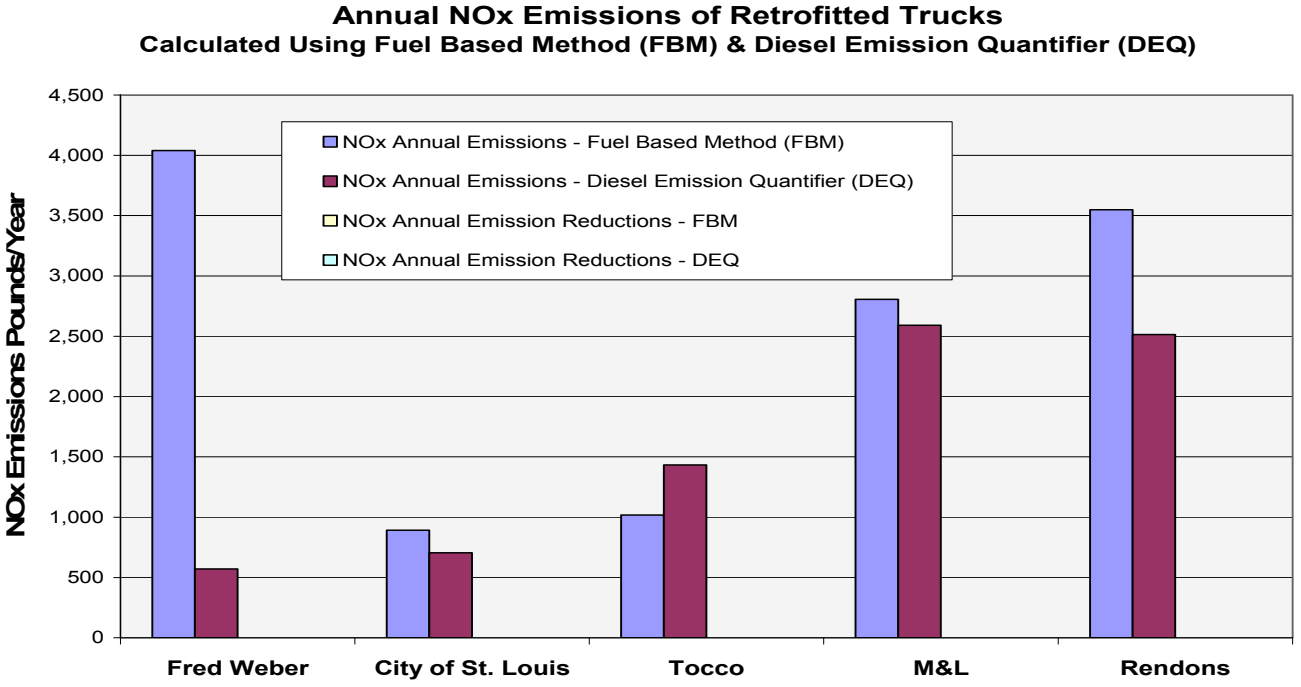
All of the companies participating in the pilot project track their vehicle miles travelled (VMT) and diesel fuel consumption as a part of doing business. For various reasons, however, among them the sample size and completeness of the data, it was not possible to demonstrate the savings in fuel and emission reductions due to the installation of the low rolling resistance tires, designation of No-Idling Zones, and idle reduction practices adopted by the drivers. These measures are each expected to be on the order of a few to several percent, for which a more uniformly controlled data collection is evidently needed. The NOx emissions reductions achieved by the increase in fuel efficiency could not therefore be documented. It was possible to estimate the annual mileage, fuel consumption, fine particulate matter (PM2.5) and nitrogen oxide (NOx) emissions and emissions reductions achieved by the installation of the diesel multi-stage filter (DMF) and diesel oxidation catalysts (DOCs). Annual VMT and fuel consumption rates for 2009 were assumed to remain constant to those reported for the first quarter of 2009. Shown below are the totals for the 1 to 3 trucks retrofitted by each of the participating fleets.



Emissions and emission reductions were estimated employing two methods; the EPA Diesel Emission Quantifier (DEQ), and a fuel-based method (FBM) for estimating heavy-duty diesel truck emissions. The fuel- based method developed emission factors for BC fine particles (diesel PM) and NOx based on volume of diesel fuel consumed.[18] Heavy-duty diesel truck emissions were measured at the Caldecott tunnel in California during 1996. The fine particle BC emission rate for heavy-duty trucks was 1.4 $\pm$ 0.2 g per kg of fuel burned. The NOx emission index was 40 $\pm$ 7 g per kg of fuel burned. NOx emission rates were found to be the same for uphill and downhill traffic, when normalized to fuel consumption.

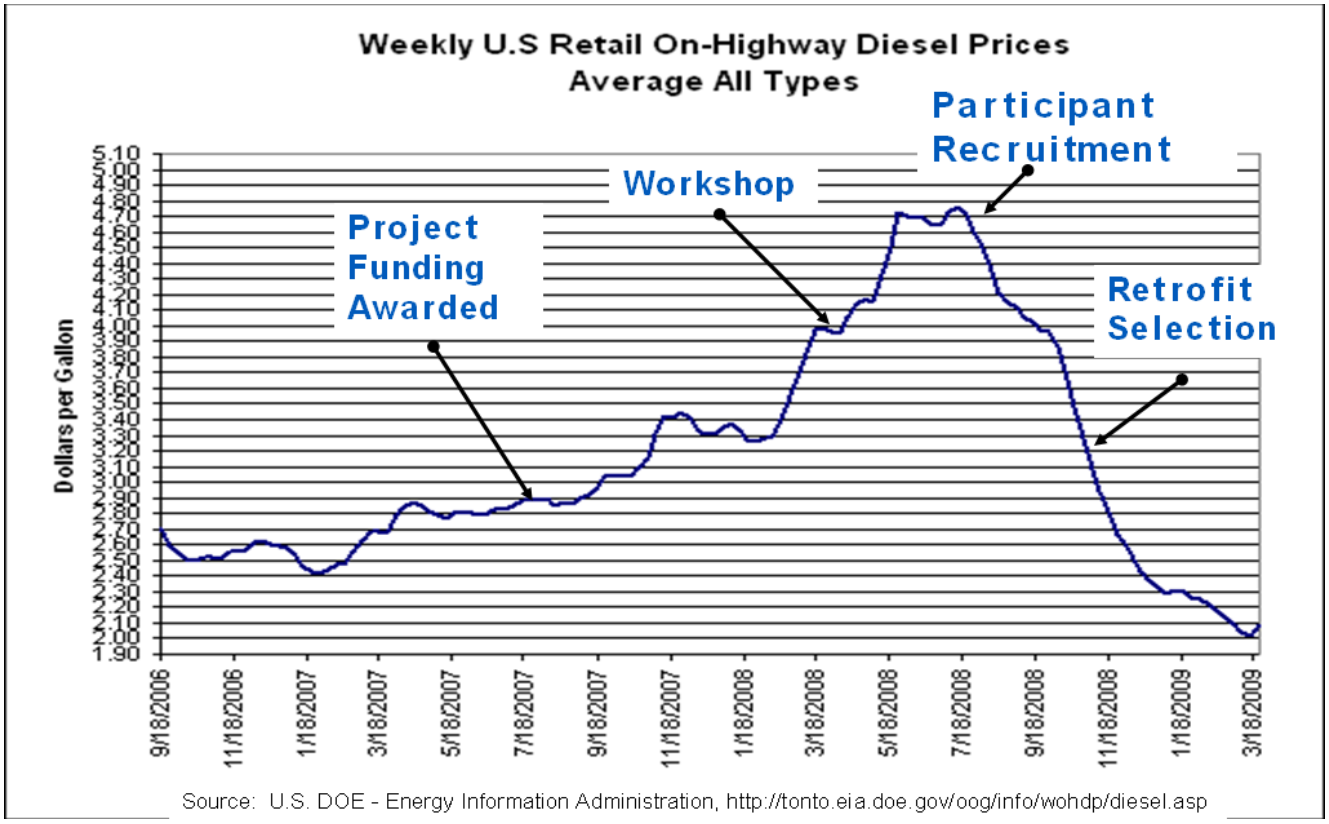


The fuel-based method was applied in a straightforward manner to the project participants' fuel consumption. The method estimates PM and NOx emissions solely upon fuel consumption without regard to miles travelled, size, type, or age of truck. The truck(s) with the greatest fuel usage were computed to have the highest emissions. It is interesting to compare this approach to that of the DEQ, which includes factors such as fuel efficiency and vehicle age. Fair agreement between the DEQ and the FBM was found for the City of St. Louis and Tocco PM2.5 emissions and emission reductions. Good agreement was found on the NOx emissions, except for the Fred Weber refuse hauler. Mileage, fuel usage, total emissions and emission reductions are tabulated in Attachment K.



- **Economic Factors Affecting Diesel Emissions & Reductions**

The change in fuel prices over the course of the pilot project played a decisive role in the trucking operations that were able to participate in the pilot project, their choices in the kinds of diesel retrofit equipment to install, and their ability to pay a portion out of pocket for equipment that would improve their fuel efficiency. Shown below is the pilot project timeline, superimposed upon the weekly average price of diesel fuel over the course of the project, as tracked by the Energy Information Administration.[22]



The skyrocketing cost of diesel fuel made it difficult or impossible for many trucking operations to stay in business. At the height of the fuel prices in May, June, and July 2008, we spoke with several independent truck drivers that were nominated by OOIDA to participate in the program. Their businesses were in such turmoil at the time that it was difficult for them to say with certainty if they would be in business for the course of the project. They were most interested in any assistance we could give them in purchasing auxiliary power units (APUs) which would enable them to shut off their engines overnight and save on fuel costs.

Modifications were made to the diesel retrofit equipment purchase options as we learned that additional flexibility in purchase options would be of assistance to them, in terms of the number and kinds of vehicles, and types of emission-reducing equipment that they would be able to purchase. By the time we were able to change the grant's purchase option requirements in order to be able to meet their requests, however, the price of fuel was beginning its downhill slide, and with it their urgent financial concern to purchase an APU and other fuel-saving retrofit equipment.

Pilot Project Company & Fleet Managers Feedback
ST. LOUIS SMARTWAY DIESEL EMISSION REDUCTION PILOT PROJECT

The Rendon's original plans to have a DOC, APU, and a full set of ten low rolling resistance tires installed on their 1998 Freightliner long haul truck had to be scaled back to a DOC and six tires, since they were unable to secure a loan or incur out of pocket expenses at the time. The reasons for the delays in retrofit installation also relate directly to the current economic downturn, which followed sharply on the heels of the fuel price hike.

The Rendons explained how intensely competitive the over-the-road trucking business for independent owner-operator drivers has become. The number of shipping contracts has nosedived along with the rest of the economy. Shippers used the decline in shipments and the descent in fuel prices to justify dropping the shipping costs paid per mile. The Rendons were fortunate they were able to find shipments to deliver, although they netted little income. Many trucking companies with four or five trucks were unable to find shipments at all, and were forced to park some or all of their trucks.

Even with the Rendon's relatively good fortune, they could find no shipments bound for Missouri. All the shipments they made were up and down the east coast, or across the southern states. For several weeks Rendon Trucking had to stay out on the road, and was unable to return to St. Louis for the retrofit equipment installations.

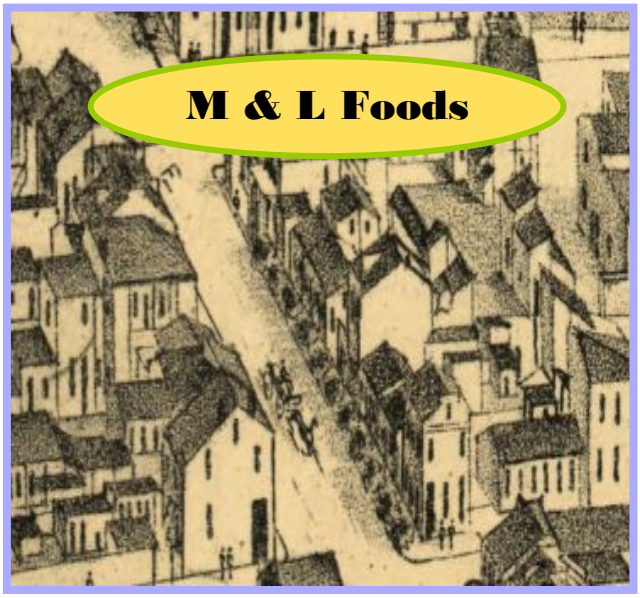
Pilot Project Company & Fleet Managers Feedback
ST. LOUIS SMARTWAY DIESEL EMISSION REDUCTION PILOT PROJECT

Fred Weber has proved to be an industry leader in reducing diesel emissions in St. Louis. Fred Weber environmental managers, mechanics and drivers assisted in troubleshooting the technical difficulties encountered with some of the first diesel particulate filters (DPFs) to be deployed. The 2007 and newer trucks had high operating temperatures associated with burning out the DPF. The high heat is dangerous on a fully loaded trash truck which transports many combustibles. Fred Weber mechanics determined how to modify the top to better disburse the heat from the exhaust.

In preparation for the installation of the diesel multistage filter (DMF) on the refuse hauler, Truck Centers delivered a temperature sensor unit for the mechanics to install, to collect temperature data during actual operation for a few days. Based on the data, Donaldson determined that the DMF would work in this application. The refuse hauler truck that was retrofitted with the DMF for the pilot project does not enter the areas posted as no-idling zones. Trash haulers do a lot of stop and go driving, and they have to idle while picking up the dumpsters to operate the hydraulics. So the mileage is always going to be lower than on a highway vehicle.

No Idling signs were installed at the Kingshighway asphalt plant, followed by the designation of a second No Idling Zone at the sand plant off Rutger Street along Lenore K. Sullivan Blvd. No Idling Zones serve to reinforce the idling restrictions in the city and county. They have identified additional idling reduction potential throughout their operations, such as the supervisors' pickup trucks and heavy equipment.

Pilot Project Company & Fleet Managers Feedback
ST. LOUIS SMARTWAY DIESEL EMISSION REDUCTION PILOT PROJECT



M & L Frozen Foods Inc. has been in business in St. Louis for four generations. Grandfather made deliveries in a horse and wagon. An environmental leader among St. Louis businessmen, the President of M & L Foods reported that they are pleased with the diesel oxidation catalysts (DOCs). They can see the difference in emissions, and have experienced no loss of power or fuel efficiency. In fact, they want to get them for all their trucks.

Management and drivers at M & L have heard about problems with the diesel particulate filters (DPFs), and that EPA is making a number of related changes. They are therefore waiting until 2010 to purchase new trucks. The low rolling resistance tires did not reduce fuel usage noticeably. These may be best for highway trucks.

Pilot Project Company & Fleet Managers Feedback
ST. LOUIS SMARTWAY DIESEL EMISSION REDUCTION PILOT PROJECT

The City of St. Louis Commissioner of Equipment Services and staff have collaborated on ground-breaking diesel emission reduction projects in the past with the American Lung Association and the St. Louis Community Air Project, which installed DOCs on about 70 trucks. Currently the City is collaborating with Grace Hill on plans for future diesel retrofit projects.

The City of St. Louis Streets Division occupies a sprawling complex off Hampton Ave. adjacent to the railroad corridor. A huge fleet of all kinds of heavy duty vehicles are stationed out in the parking areas, and serviced in the cavernous garages. Staff collaborated with Grace Hill on the posting of No-Idling Zone signs at many locations at the complex, as well as throughout the city. A noticeable reduction in exhaust fumes is the result, which benefits the entire metropolitan area.

Pilot Project Company & Fleet Managers Feedback
ST. LOUIS SMARTWAY DIESEL EMISSION REDUCTION PILOT PROJECT

According to the Tocco Foods Company President, fine foods are a family tradition that goes back to the late 1800's in Terrasini, Sicily. The Toccos came to America in 1905 and began selling seafood during the 1920s around the Carr & Cass area. In the beginning they used a cart, and later a horse and wagon, until the company purchased a truck. Trucks caught on, and the city filled with them.

Rather than returning to horse-drawn deliveries to reduce emissions, Tocco Foods decided to try installing diesel oxidation catalysts (DOCs) on two of their refrigerated delivery trucks, along with a set of low rolling resistance tires. They are quite pleased with the results; the trucks do not smoke as bad, and the new tires handle better. They designated No-Idling Zones in front and back which are also working well for them. They want to install more diesel filters, low rolling resistance tires, and test drive other new SmartWay technologies and strategies as well.

- **Evaluation of SmartWay Emission Reduction Strategies**

Experience from this pilot project has demonstrated trucking companies need more technical and funding assistance to reduce diesel emissions as economic conditions tighten. Fuel prices climbed so steeply in 2008 that SmartWay equipment that previously was affordable, no longer was within the budget for many trucking firms, unless it reduced fuel consumption, and/or was covered by DERA or ARRA funding. EPA and OOIDA have finance programs for trucking companies to install selected SmartWay packages that may also make a difference, particularly if they provide technical assistance. Engine Control Systems, an EPA-verified DPF manufacturer, shared their insights on how to market DOCs and DPFs to truckers.

> *"Based on our experience it is almost impossible to get this market group to purchase this product unless it is 100% funded by state or federal funding. Even when the product and labor is fully covered, the sales process still requires a lot of persistent selling to get the fleet manager to install a DOC or DPF on their vehicles. Because this is not a mandated program like the California market, truckers are reluctant to install this product on their expensive vehicles. It truly does take a fleet manager that has a "green" mentality to make a project like this happen. It is baffling to me how many fleets decide not to apply for the federal funding that covers 100% of the product when it helps the environment and does not cause any negative effect on their vehicle.* ***The more pressure and education your department can apply to fleet managers combined with the retrofit vendors' sales efforts, the greater the chance of success for your pilot program."***

Despite the fact that DPFs achieve the greatest diesel emission reductions of any technology to date, since they do not improve fuel efficiency (or reduce greenhouse gas emissions), trucking operations are not lining up to pay $10,000 for them. DOCs in contrast appear to have wide acceptance as the available federal funding covers 100% of the cost and no maintenance is needed. The Donaldson DOCs installed in the pilot project achieve 25-30% PM reductions, hydrocarbon (HC) reductions in the range of 50%, and carbon monoxide (CO) reductions in the range of 40%. The optimal solution, however, appears to be the diesel multi-stage filter (DMF) installed by Fred Weber. The DMF is 65+% efficient for PM and 80% reduction for HC and CO. No maintenance is required, and the cost is approximately $5,000.

Long haul retrofit options - The installation of an APU offers substantial emissions reductions for those trucking operations with the greatest need of the funding. If APUs could be brought down in price without sacrificing quality this would be a great boost to both fuel savings and air quality. APUs should come standard on new over the road trucks. Streamlining cab attachments have been installed by most, but by no means all over the road trucks, so there is room for an increase in fuel efficiency. Van fairings on the other hand are rarely used. If fuel savings justify their installation this would be a great measure to promote. Low rolling resistance tires may still prove their efficacy on city streets.

Both short & long haul trucks - Based on this assessment, the greatest emission reductions achievable by most heavy-duty diesel trucks is to install a DOC or DMF, CCV, low rolling resistance tires, and adopt no-idling practices. Over the road trucks should also add a NOx engine reflash adjustment, obtain financing for the purchase of an APU, and streamlining attachments. Driving and idle reduction practices have great potential to reduce fuel consumption and improve air quality. Outreach and education is important for fleet managers and drivers to hear the latest developments in diesel emission reduction technologies and strategies.

IV. Lessons Learned and Recommendations from the Pilot Project

- Dedicated staff for a city or statewide diesel emission reduction program would be a worthwhile investment. The development of an inventory of diesel vehicles and their emissions would be one function of such a program.

- A city or statewide forum for education and outreach on freight transportation issues, new technologies, and driver training might be similar in approach to the St. Louis Chapter of the U.S. Green Building Council.

Education & Outreach

- Education & outreach are important tools in working with the freight transport industry in order to establish:

    - A database of trucking companies, municipal and industry-owned trucking fleets, and independently owned and operated truck drivers.

    - A database of nonroad companies such as in the railroad, marine, construction, mining, agricultural, and aircraft industries.

    - An inventory of both onroad and nonroad vehicles and emissions. The inventories would facilitate collaboration and prioritization of the highest diesel emitters.

    - Communication with and between city or regional planning, shipping, and transport operations on new technologies, strategies, regulations, funding, and projects. This includes energy efficiency advancements via infrastructure, congestion mitigation, traffic control center, and smart grid innovations.

Diesel Retrofit Technologies

- The worst emitting trucks should be replaced with 2007 or newer vehicles.

- Diesel retrofit technology that fleets can and will install is heavily determined by fuel prices and other economic conditions. Affordable, fuel-saving technologies are the future of diesel-powered freight transport.

- APUs should come standard on new long haul trucks. APU prices should be reduced for retrofits.

- New energy efficient vehicle technology is essential for future criteria and hazardous air pollutant and GHG reductions, such as the hydraulic hybrid for buses, refuse, and delivery trucks, and the Scuderi engine for cars, trucks, ships, trains, planes, and other internal combustion engines.

OOIDA (Owner-Operator Independent Drivers Association) Recommendations

- There is an epidemic shortage of parking for over the road trucks throughout the U.S. This leads to parking and idling of vehicles overnight in residential areas, impacting the health of urban residents including children. Overnight parking and services for over-the-road trucks are needed at the major routes coming into all cities to address this problem.

- Typical loading dock hours are 8 AM to 5 PM. Longer loading dock hours would result in fewer trucks idling in cities overnight, waiting for the loading docks to reopen in the morning.

- Rules affecting over the road trucking such as idling limits and retrofitting requirements should be applied evenly across the U.S., rather than in a patchwork quilt that drivers cannot keep track of.

- Intermodal/Smart freight transport to utilize the existing workforce and vehicles, phasing in of more energy efficient transport such as from trucking to rail, should be coordinated with the retirement of older vehicles, new employment opportunities, and training for truck drivers, such as in the green diesel and related transportation industries.

Public Health Protections

- Diesel trucks have overhead exhaust pipes that can discharge directly into the open windows of homes. These trucks should be restricted as much as possible from using residential streets as thoroughfares.

Possibilities for Future Diesel Emission Reduction Programs

- Replace the worst-emitting 10% of trucks that are responsible for 90% of diesel emissions.

- Identify worst emitters with remote sensing or visually, via opacity violations.

- Hydraulic hybrid replacements for refuse and delivery trucks and buses with frequent stop and go driving.

- No-Idling signs are needed at truck stops and loading zones to secure compliance with idling restrictions.

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List of Attachments

Attachment A: Budget

Attachment B: Timeline

Attachment C: Grace Hill Workplan

Attachment D: Workshop Flyer

Attachment E: Publicity

Attachment F: Workshop Agenda

Attachment G: Pilot Project Sign Up

Attachment H: Workshop Evaluation

Attachment I: Pilot Project Application

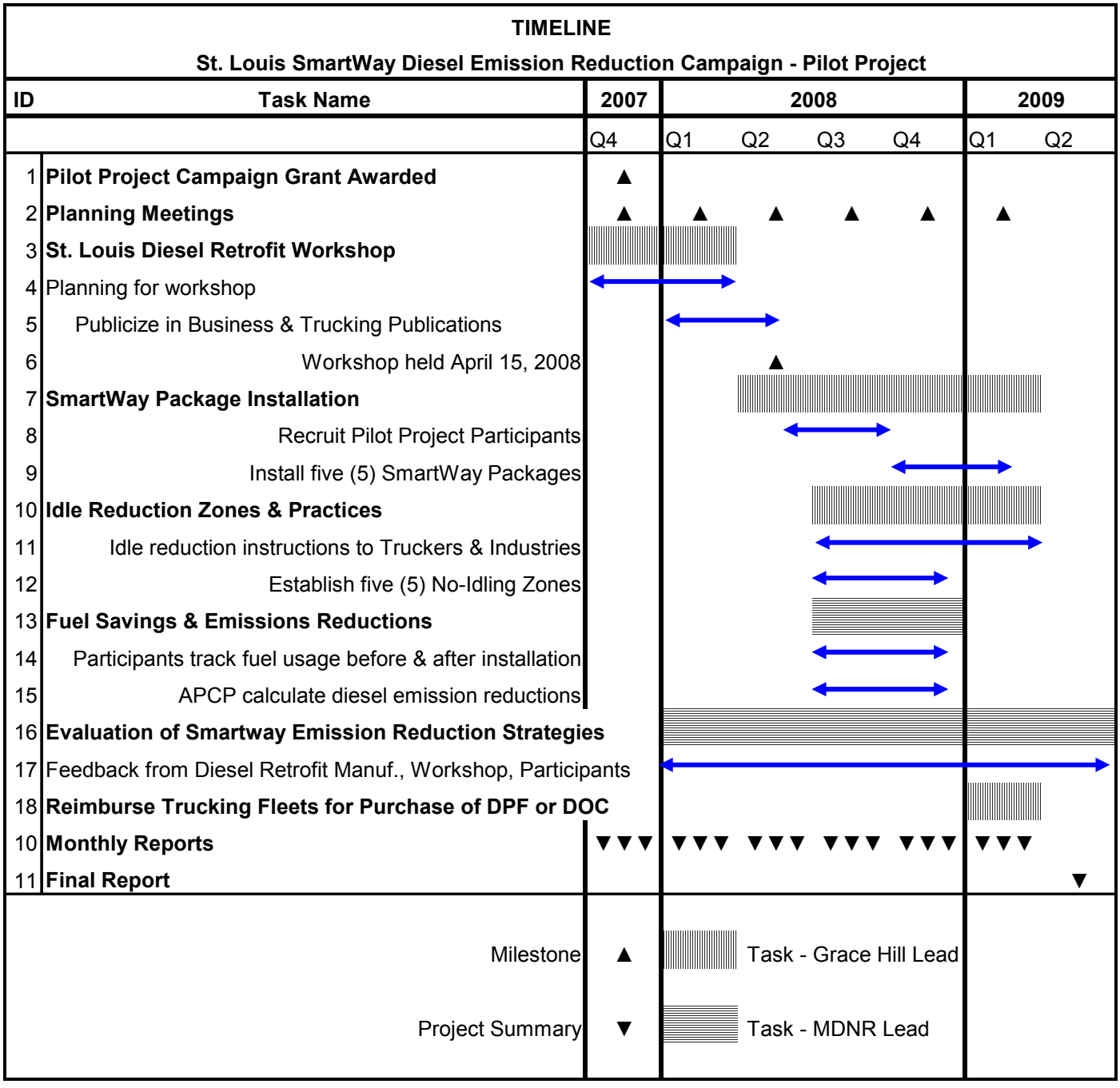
Attachment J: EPA-Verified Diesel Retrofit Equipment Companies & Installers in St. Louis

Attachment K: Mileage, Fuel Usage, & Emissions Summary

Attachment A: Budget

AIR POLLUTION CONTROL PROGRAM FY 2007 BLUE SKYWAY PROJECT DETAIL BUDGET				
Org 3410	**BUDGET CATEGORIES**	**TITLE**	**PERCENTAGE OF TIME COMMITTED TO PROJECT**	**BUDGET CATEGORY TOTALS**
PERSONAL SERVICE Oversee project, assist with presentation	**TOTAL PERSONAL SERVICE**	Chemist III	10%	**$4,370**
FRINGE @ 42.2	**TOTAL FRINGE**			**$1,844**
TRAVEL @ .23 a mile Travel to St. Louis for APCP's personnel attendance at presentation				
	TOTAL TRAVEL			**$80**
EQUIPMENT	Five (5) Diesel Particulate Filters or DPFs (@$4,500 each) **TOTAL EQUIPMENT**			**$22,500**
TOTAL DIRECT COST				**$28,714**
Program Specific Distribution (PSD) Subgrant to Grace Hill	**TOTAL PSD**			**$24,863**
INDIRECT @ 22.92				**$1,423**
TOTAL PROGRAM COST				**$55,000**

Attachment B: Timeline



Attachment C: Grace Hill Workplan

ST. LOUIS SMARTWAY DIESEL EMISSION REDUCTION PILOT PROJECT
GRACE HILL SUBGRANT WORK PLAN
October 1, 2007 through April 30, 2009

Grace Hill, in collaboration with the Missouri Department of Natural Resources, Air Pollution Control Program, will assist with carrying out the pilot diesel emission reduction SmartWay campaign in St. Louis. This demonstration project may help lay the groundwork for a larger diesel emission reduction project in the St. Louis area. This subgrant will fund the Grace Hill's participation in this project.

This work plan outlines Grace Hill's contribution below, the basic elements of which are:

1. Plan, organize and host one (1) SmartWay presentation to local heavy duty onroad trucking companies and trucking fleets of other types of companies.
   a. Select a location to hold the presentation;
   b. Set a date for presentation;
   c. Plan the agenda with MDNR's assistance for the presentation;

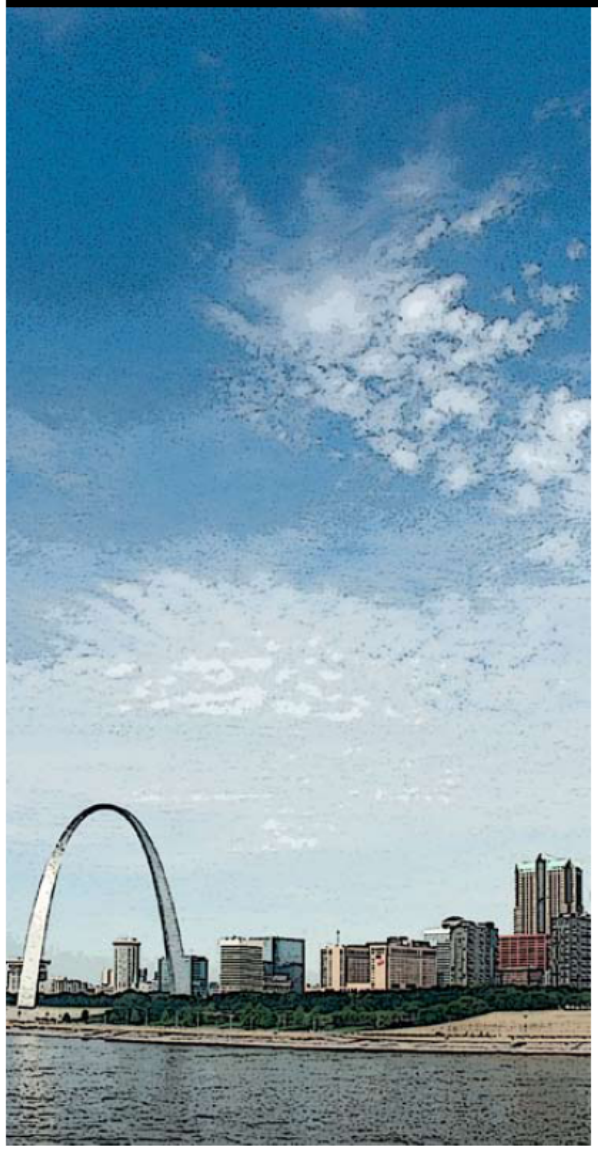
2. Prepare and submit two (2) articles or announcements for the St. Louis area to publicize the presentation.
   a. Submit article(s) to MDNR first for approval;
   b. Articles can be submitted to local business journals, trucking publications, newspapers, or radio;

3. Recruit local heavy duty onroad trucking companies or fleets to participate in the pilot project in the St. Louis area.
   a. Recruit at least five (5) companies to come to the presentation;
   b. Ask attending companies to register ahead of time if possible;

4. Provide five (5) signs and a speaker on "No-Idling" for the presentation.
   a. Provide "No Idling" signs to be installed at the five participating trucking companies' new Idle-Free Zones;
   b. Present information on the Idle-Free Zones and display "No Idling" signs;

5. Assist and track the installation of five (5) SmartWay packages on the participating companies' vehicles.
   a. Work with the trucking company to select the most effective retrofit technologies for their trucking fleet;
   b. Work with MDNR to approve the selected SmartWay package, particularly the diesel particulate filters (DPF) or diesel oxidation catalysts (DOC) to be reimbursed;
   c. Assist MDNR with collecting survey information for tracking heavy-duty diesel fuel savings, emissions, and emission reductions;
   d. Provide a brief report to MDNR on the retrofitting installation, including any feed back received during the retrofitting process.

St. Louis Diesel Retrofit Workshop and Expo



Anheuser-Busch Visitor Center

South 12th and Lynch Street, St. Louis

April 15, 2008 8 a.m. to 4 p.m.

SmartWay packages designed by the U.S. Environmental Protection Agency and Leading Diesel Retrofit Companies.

Who should attend?

The St. Louis Diesel Retrofit Workshop and Expo will present SmartWay diesel retrofit equipment and idle reduction strategies. Trucking, industrial, commercial and service fleet operators will benefit from this workshop. Improving fuel efficiency, air quality and reducing greenhouse gas emissions go hand in hand. The U.S. EPA and diesel equipment companies have been working together to design a wide range of fuel-saving strategies and retrofit equipment. **Participating trucking fleets who install SmartWay packages with Diesel Particulate Filters or Diesel Oxidation catalysts may be eligible for reimbursement.**

This is a FREE workshop.

Lunch will be hosted by Anheuser-Busch, Caterpillar, Cummins, Engine Control Systems and Fabick.

How to Register

Participants should register by April 10, 2008, by calling (314) 584-6709 or on the Web at www.dnr.mo.gov/env/apcp/dieselretrofitprogram.htm.

Missouri Department of Natural Resources

BLUE SKYWAYS COLLABORATIVE

GRACE HILL Clean Air Project

SmartWay Transport Partnership U.S. Environmental Protection Agency

Attachment E: Publicity

Attachment F: Workshop Agenda

AGENDA
ST. LOUIS DIESEL RETROFIT WORKSHOP

Anheuser-Busch Visitor Center
12th & Lynch Streets
April 15, 2008

8:00 a.m. **Registration and Exhibit Viewing**

8:20 a.m. **Welcome**
Jim Kavanaugh, Director, Air Pollution Control Program,
Missouri Department of Natural Resources

8:30 a.m. **Diesel Emissions Reduction Overview**
SmartWay Transport Partnership and Pilot Project
Mollie Freebairn, MoDNR/APCP

9:00 a.m. **Heavy-Duty Diesel Idle Reduction Rule**
Tiffany Campbell, MoDNR/APCP

9:20 a.m. **Idle-Reduction Strategies**
Establishing No-Idling Zones
Lauren Mitchell, Grace Hill Clean Air Program (CAP)

DIESEL EMISSION REDUCTION TECHNOLOGIES

9:40 a.m. **Engine Control Systems (ECS)**
Dana Brewster, Central Region Sales Manager

10:00 a.m. **Break - Coffee and Exhibits**

10:20 a.m. **Caterpillar Emissions Solutions**
Ed Woods, Territory Manager, and Jeff Mayberry, Fabick/Caterpillar

10:40 a.m. **Cummins Emissions Solutions**
Judy Murphy, Retrofit Sales, and Chris Lamere, Cummins Mid-South

11:00 a.m. **Donaldson Filtration Solutions**
Cory Anderson, Account Manager

11:20 a.m. **Eaton Corporation – Hybrid Truck Technology**
William Batten, Director for Government Sales

11:40 a.m. **Q & A Session - Diesel Retrofit Companies & Trucking Fleet Managers**

12:00 p.m. **Caribbean Lunch – Provided by the Diesel Equipment Companies**

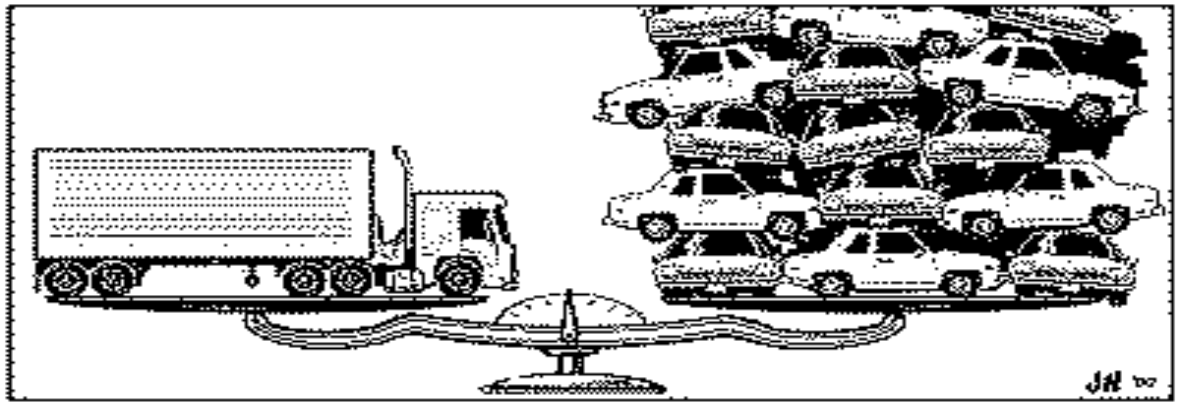
AGENDA
ST. LOUIS DIESEL RETROFIT WORKSHOP

Anheuser-Busch Visitor Center
12th & Lynch Streets
April 15, 2008

1:00 p.m. **Diesel Emission Reduction Panel Discussion**
Moderator - Doug Eller, Grace Hill Clean Air Program
Panelists Invited From The Following Organizations:
Amy Bhesania, EPA Region 7/Blue Skyways
Leanne Tippett Mosby, Missouri Department of Natural Resources
Tim Embree, City of St. Louis Mayor's Office
Rory Roundtree, City of St. Louis Board of Aldermen
Susan Schau, St. Louis Regional Asthma Consortium
Susannah Fuchs, American Lung Association of the Central States
Bud Getz, Lohr Distributing
Steve Nagle, East-West Gateway Council of Governments
John Stier, Anheuser-Busch

2:00 p.m. **Social Hour – Hosted by Anheuser Busch**
An opportunity for further information exchange between Fleet Managers, Panelists, Diesel Retrofit Manufacturers, and others in attendance

4:00 p.m. **Anheuser-Busch Brewery Tour**



One truck can emit as much pollution as 100 cars!

Attachment G: Pilot Project Sign Up

SmartWay Transport Partnership
U.S. Environmental Protection Agency

Grace Hill Clean Air Project

Trucking fleets who install SmartWay packages with Diesel Particulate Filters (DPFs) or Diesel Oxidation Catalysts (DOCs) may be qualified for a Diesel Retrofit Pilot Program and be reimbursed for up to $4,500.

Sign Up Here for more information about participating in the St. Louis Diesel Retrofit Pilot Project

Company Name_____

Address_____

City, State, ZIP_____

Contact Person Name_____

Title_____

Phone_____

Email_____

Please Leave with MoDNR & Grace Hill at Workshop

Attachment H: Workshop Evaluation

Summary of Evaluation Forms

2008 Diesel Expo and Workshop

Total Evaluations Received: 23

1=Poor (Unsatisfactory)
2=Adequate (marginal)
3=Good
4=Very Good
5=Excellent (Above expectation)

Facilities:						
Accommodations	1	2	3	4	5	**Avg. 4.913**
Food and Beverage	1	2	3	4	5	**Avg. 4.434**
Hospitality and Registration	1	2	3	4	5	**Avg. 4.739**
Room set-up	1	2	3	4	5	**Avg. 4.826**
Logistics:						
Online Registration	1	2	3	4	5	**Avg. 4.421**
Expo Website (User friendly?)	1	2	3	4	5	**Avg. 4.353**
Workshop Packet	1	2	3	4	5	**Avg. 4.217**
Workshop Registration Line	1	2	3	4	5	**Avg. 4.381**

Presentations:

How would you rate the overall clarity of the workshop/presentations?
1 2 3 4 5 **Avg. 4.174**

Do you feel your attendance at the workshop was worthwhile?
1 2 3 4 5 **Avg. 4.261**

Did you learn anything new at our workshop?
1 2 3 4 5 **Avg. 4.565**

The benefits of the presentations to my company, organization, non-profit will be
1 2 3 4 5 **Avg. 4.261**

Would you recommend this workshop to your colleagues?
1 2 3 4 5 **Avg. 4.391**

Follow up: (Impact on behavior)

Does your company currently have a "No Idling" policy?
1 2 3 4 5 **Avg. 2.778**

If not, are you interested in getting a "No Idling" policy and zone?
Yes or No (please circle one) **Yes-10, No-2, Maybe=1**

How many diesel engines does your fleet have? **Range 2 to 1500**
(#'s Recd.: 37, 2,30, 33, 1500, 140, 65, 65, 350, 350, 100+, 100+, 100+, 0, 150+, 1300 & don't know)

How many are retrofitted? **Range 0-64**
(#'s Recd: 0 (9 times), 1 (2 times), 20, 64, N/A for St. Louis Co. attendees, and don't know)

Are you interested in Retrofit and fuel savings technology?	Yes or No	**Yes-17, No-0**
Are you a Blue Skyways partner?	Yes or No	**Yes-4, No-13**
Are you a Smartways Transport Partner?	Yes or No	**Yes-1. No-16**
Would you like to join one of these?	Yes or No	**Yes-6, No-3**

Attachment I: Pilot Project Application

St. Louis Diesel Retrofit

Pilot Project Application

Congratulations! You've been selected to apply to participate in the St. Louis Diesel Retrofit Pilot Project. You can help reduce diesel emissions *and* improve your fleet fuel economy by retrofitting your pre-2007 trucks with diesel emission reduction equipment, which the Environmental Protection Agency (EPA) calls a SmartWay Package or Upgrade Kit.

This pilot project is sponsored by the EPA Region 7 and the Central States Air Resources Agencies (CenSARA). The Grace Hill Clean Air Program (CAP) in St. Louis and the Missouri Department of Natural Resources – Air Pollution Control Program in Jefferson City jointly administer the project. See http://www.dnr.mo.gov/env/apcp/dieselretrofitprogram.htm.

PROJECT FUNDING REQUIREMENTS

Participants will be reimbursed up to a total of $4,500 for the cost and installation of one or more pieces of diesel emission reduction retrofit equipment on one or more onroad vehicles. The total cost of the equipment installed must exceed $4,500, in order to include a cost share paid for by the truck or fleet owner. Fleet managers and truck drivers will receive consultation by Grace Hill Clean Air Project and establish No-Idling Zones and Idle Reduction practices to maximize fuel savings. The purchase requirements and options are:

- The $4,500 must be used to purchase and install at least one diesel particulate filter (DPF) or diesel oxidation catalyst (DOC) on an onroad diesel vehicle.

Remaining funds may optionally be used to:

- Install a crankcase ventilation system (CCV) and NOx Engine Reflash Adjustments in addition to the installation of a DPF or DOC.
- Install one or more DOCs, CCVs, and NOx Engine Reflash Adjustments on additional vehicles.
- Use remaining funds for the purchase of an APU or other idle reduction equipment such as bunk heater or battery-powered air conditioner.

Equipment purchased or installed prior to application approval for the funding are not eligible.

For additional information on SmartWay Fuel-Saving Strategies, Diesel Emission Reduction Retrofit Equipment, and Idling Reduction Technologies please review the following websites below or give us a call at (314) 584-6856. Ask for Lauren Mitchell, MSW- Idle Project Coordinator.

SmartWay Upgrade Kits -
http://www.epa.gov/smartway/transport/what-smartway/upgrade-kits-tech.htm
SmartWay Technologies & Strategies -
http://www.epa.gov/smartway/transport/what-smartway/carrier-strategies.htm

St. Louis Diesel Retrofit

Pilot Project Application

Requirements:

- Participant must be a St. Louis located Owner, Operator or Fleet; and all truck(s) must be legally registered in Missouri.
- Establish No-Idling Zones; Drivers will be given training on idle-reduction practices.
- Agree to keep a two (2) month log of vehicle gasoline usage (one (1) month before & after retrofit installation); Log sheets will be provided.
- Register or be registered with the Department of Natural Resources, as a vendor, in order to be reimbursed. You may do this online at **http://oa.mo.gov/acct/pdffiles/vendor_input_form.pdf**.
- Want to save fuel cost, reduce harmful air pollutants and want better air quality for St. Louis residents.

SECTION 1 – PARTICIPANT INFORMATION

Company/Owner-Operator Name_____

Contact Person_____

Title_____

Fleet Address_____

City_____ State_____ Zip Code_____

Phone_____ Fax_____

Email Address_____

SECTION 2 – FLEET INFORMATION

Number of trucks in fleet_____

Estimated number of trucks with emissions reduction equipment in fleet_____

Does your company currently have No-Idling or Time Limited Idling Zones? Yes or No

Are Idle-reduction practices required or encouraged while out on the road? Yes or No

EPA SmartWay member: ____Yes ____No (SmartWay membership is not mandatory.)

Note: To become a Member of EPA SmartWay Program log on at www.smartway.gov.

Indicate approximate number of emission reduction equipment already installed in fleet:

Idling Reduction Technology	Streamlining Equipment	Emission Reduction Devices
_____Bunker Heater	_____Van aerodynamics	_____Crankcase Ventilation
_____Battery Air Conditioner	_____Trailer aerodynam.	_____Diesel Oxidation Cat.
_____Auxiliary Power Unit	_____Single-Wide Tires	_____Diesel Particulate Fil.
_____ _____	_____ _____	_____ _____

(Indicate other diesel retrofit equipment)

SECTION 3 – EQUIPMENT TO BE INSTALLED

Please identify vehicle(s), type of device(s) to be installed, and costs:
Total Amount to be reimbursed cannot exceed $4,500.00

Vehicle Description and ID Number (VIN)	Engine Year	Type of Emission Reduction Equipment: DCO, DPF, CCV, Bunk Heater, APU, etc.	Purchase + Installation Price Quote(s)	Total Cost To Fleet or Truck Owner	Amount to be Reimbursed
			Total Cost To Participant:		
				Total amount to be reimbursed: ***(Cannot exceed $4,500)***	

SECTION 4 – CERTIFICATION STATEMENT

The Participant:

1. Certifies to be a St. Louis located Owner-Operator, Company, or Fleet.
2. Truck(s) to be retrofitted is (are) registered in MO.
3. Agrees to establish No-Idling Zones at St. Louis company location, if applicable, with the assistance of Grace Hill Clean Air Program (CAP).
4. Agrees to adopt idle-reduction policies for Company or Owner-Operator Drivers, with the assistance of Grace Hill CAP.
5. Agrees to provide a one (1) to two (2) month log of vehicle gasoline usage (preferably 1 month before if time allows, & 1 month after retrofit installation), with odometer readings, diesel purchases and mileage (mpg) for each truck receiving retrofit equipment. Log sheets will be provided.
6. I understand and agree with the reimbursement policies set forth below.

SECTION 5 - PARTICIPANT CERTIFICATION

I certify to the best of my knowledge that the information in this application is true and correct. I am a legally authorized signatory or designee for the submittal of this information, and any other required information on the behalf of the participant.

_____ _____

Signature Title

_____ _____

Print Name Date

Please return the completed application to:

Douglas Eller, Program Director
Grace Hill Settlement House-Clean Air Project
2600 Hadley Street
St. Louis Missouri, 63106
(314) 584-6703 (314) 584-6907

The Pilot Project reimbursement process by the Department of Natural Resources:

1. Complete entire Pilot Project Application specifying vehicle(s) to be retrofitted and equipment by [add dates-after extension approved].
2. Fill out a Missouri State Vendor Input Form online at http://oa.mo.gov/acct/.
3. After approval notification, order and install the approved equipment on the vehicle(s).
4. Grace Hill will then verify that the equipment is correct and was installed, get a copy of the paid invoice(s) for the equipment and installation.
5. Grace Hill will provide the "No Idling" sign and the trucking company will install in the designated zone.
6. Grace Hill will then sign their approval on the invoice(s) and forward to DNR.
7. APCP will verify that all the documentation is correct. The reimbursement payment will be sent to the trucking company per the method they signed up for on the Vendor Input Form.

Attachment J

CenSARA / Blue Skyways St. Louis Diesel Emission Reduction Pilot Project
Price Range Estimates on DOCs, DPFs, DMFs, CCVs, & NOx Engine Reflash
EPA website on diesel retrofit contacts at http://www.epa.gov/otaq/retrofit/contacts.htm:

COMPANY	DOC	DPF & Partial DPF	CCV	NOx Engine Reflash	APU
Engine Control Systems (ECS) www.enginecontrolsystems.com Dana Brewster 9436 Ravenna Road Chardon, Ohio 44024 (440) 840-2511 Office/Cell (440) 286-1660 Fax dabr@enginecontrolsystems.com Dana will arrange St. Louis Install	**DOC-20%** $600-$1100 PM- 20% HC 60% CO 30% **DOC-40%** $850-$1300 PM- 40% HC 70% CO 40%	**DPF** $6200-$7500 PM 90% HC 85% CO 75%	**CCV** $350-$500 PM 100% **DOC 40%+CCV** $1200-$1800 PM- 40% HC 75% CO 60%	Not available	Not available
Donaldson www.donaldson.com Cory Anderson 952-887-3779 Cory.Anderson@Donaldson.com St. Louis Installer: **Truck Centers** Tim Stellhorn 1-800-325-8809	**DOC-20%** $800-$1,300 + $200 installation	**DPF-85-90%** $7,000-$9,500 + $300 installation **DMF-70%** $5,200 + $200 installation	**Spiracle CCV** $380 + $300 installation	Not available	Not available
Fabick/Caterpillar Jeff Mayberry One Fabick Drive Fenton, MO 63026 (636) 680-1337 direct (800) 845-9188 toll free (636) 349-9272 fax jeff.mayberry@johnfabick.com www.fabickcat.com	**DOC** 200-600 HP $1000--$9000 PM reduction up to 20% Carbon monoxide-85% Hydrocarbon-69%	**DPF** Thomas Bus Ap. Assembly cost - $8500-$10,500 Install kit $200 plus labor PM, CO, HC reductions up to 90%	**CCV** Not available	**NOx Engine** **Reflash** $200 (About)	**APU** About $8,000 parts and labor
Cummins MidSouth Steve Dodson 7210 Hall St. St. Louis, MO 63147 Phone: (314) 389-5400 Fax: (314) 389-9671 http://www.cummins.com george.p.choulas@cummins.com	**DOC** 1500-3000	**DPF** $1,500 - 13,800 installed Partial $3-5,000	**CCV** $300	**NOx Engine Reflash** $350	**APU** $12,000 + labor

Attachment K: Mileage, Fuel Usage, & Emissions Summary

	St. Louis Diesel Retrofit Pilot Project Mile, Fuel Usage, & Emissions Summary						
	Fred Weber	City of St. Louis	Tocco	M&L	Rendon's	TOTAL	
Annual Miles 2009	34070	14257.8	32120	60624	76584	**217,656**	
Annual Gallons 2009	13407.12	2960.88	3380	11964	11782.15385	**43,494**	
Annual MPG 2009	2.54	4.8154	9.50	5.07	6.5		
						TOTAL	TOTAL
	Fred Weber	City of St. Louis	Tocco	M&L	Rendon's	Tons/Year	Lb/Yr
PM2.5 Annual Emissions - Fuel Based Method (FBM)	0.0696	0.0154	0.0176	0.0484	0.0612	0.212	**424.34**
PM2.5 Annual Emissions - Diesel Emission Quantifier (DEQ)	0.0089	0.0104	0.0118	0.0207	0.0180	0.070	**139.60**
PM2.5 Annual Emission Reductions - FBM	0.0453	0.0042	0.0053	0.0145	0.0184	0.088	**175.36**
PM2.5 Annual Emission Reductions - DEQ	0.0058	0.0031	0.0035	0.0062	0.0054	0.024	**48.04**
						TOTAL	TOTAL
	Fred Weber	City of St. Louis	Tocco	M&L	Rendon's	Tons/Year	Lb/Yr
NOx Annual Emissions - Fuel Based Method (FBM)	2.0196	0.4460	0.5092	1.4033	1.7748	6.15	**12,305.86**
NOx Annual Emissions - Diesel Emission Quantifier (DEQ)	0.2858	0.3528	0.7166	1.2962	1.2566	3.91	**7,816.00**
NOx Annual Emission Reductions - FBM	0	0	0	0	0	0	**0**
NOx Annual Emission Reductions - DEQ	0	0	0	0	0	0	**0**