Final Report

Grant Program:	**American Recovery and Reinvestment Act/Diesel Emission Reduction Act (ARRA/DERA)**
Project Title:	**STIMULUS - CT State Clean Diesel Grant Program**
Grant Recipient:	**Connecticut Department of Energy & Environmental Protection (DEEP)**
Grant Number:	**96102001**
EPA Award Amount:	**$1,730,000**
Date Submitted:	**April 20, 2012**

Table 1. Expenditures
(Record all funds expended for each budget category.)

	Total Federal Funds Expended	Total Cost-Share Expended	Total Additional Leveraged Funds Expended
Personnel	$46,195.63		
Fringe Benefits	$26,706.96		
Travel			
Equipment			
Supplies			
Contractual			
Other	$1,489,655.47	$312,250.82	$250,000.00
Indirect Charges	$17,106.54		
TOTALS	$1,579,664.60	$312,250.82	$250,000.00

Table 2. Actual Results

	NO_X	PM	HC	CO	CO_2
Annual Reductions (tons)	39.48	1.78	1.28	11.87	217.93
Lifetime Reduction (tons)	598.84	23.31	17.06	165.83	3,608.29
Capital Cost Effectiveness ($/ton)	$2,453	$63,018	$86,064	$8,857	$407
Total Project Cost Effectiveness ($/ton)	$2,638	$67,782	$92,569	$9,526	$438
Gallons of Diesel Fuel Saved	Annual = 21,046 gal/yr		Lifetime = 247,610 gal		

Provide a narrative description of the project.

Initially, Connecticut's proposal had three components: 1) a construction vehicle retrofit program to expand the fleet of clean construction equipment and to retrofit state maintenance trucks; 2) the establishment of an electrified truck stop to reduce the impact of drayage truck idling in and around the Port of New Haven; and 3) a locomotive engine conversion project for a locomotive used as a switch engine at the rail yard in New Haven. The switch engine project was terminated after the owners became unable to provide matching funds. A marine engine upgrade project was selected as a replacement.

Connecticut Department of Transportation (ConnDOT) Retrofit Project: ConnDOT installed diesel oxidation catalysts (DOCs) on 149 of its own maintenance trucks that are used for snowplowing in the winter. DOCs were also installed on 19 construction vehicles used on four designated highway projects through the use of contract specifications on those projects. Using similar contract specifications, five additional pieces of construction equipment, used on two other highway projects, were retrofitted with diesel particulate filters (DPFs). Encouraging the use of clean diesel construction specifications was recommended in the Connecticut Clean Diesel Plan of 2006, which can be found at http://www.ct.gov/dep/lib/dep/air/diesel/docs/ctcleandieselplanfinal.pdf, as a method for enlarging the retrofitted construction fleet and providing cleaner air around construction sites. In general, clean construction contract specifications set out minimum requirements for construction equipment emission controls that must be incorporated into the terms and conditions of the base contract for highway and other construction projects. Connecticut took the lead in establishing such specifications for contracts associated with the "Q Bridge" project in New Haven. This successful initiative has resulted in over 100 pieces of diesel powered construction equipment being retrofitted with DOCs.

The contract specifications used for this program, which appear as Attachments A and B, required that construction equipment, above a specified horsepower (hp), be retrofitted with emission controls that would be paid for by the sub-grant. The specifications were incorporated into contracts for selected projects in Fairfield and New Haven Counties, which are in nonattainment with the National Ambient Air Quality Standards (NAAQS) for particulate matter. For this project, ConnDOT added the recommendation that all verified retrofit devices installed with ARRA/DERA Program funding remain in use throughout useful life of the piece of equipment. By enlarging the fleet of retrofitted equipment available, this program will expand the air quality benefits of cleaner construction equipment to subsequent projects in Connecticut and the region. The installation of the retrofit devices created jobs in Connecticut.

City of New Haven Truck Stop Electrification (TSE) Project: New Haven's proposal to install a truck stop electrification (TSE) facility was consistent with a recommendation in the Connecticut Clean Diesel Plan of 2006, to pursue funding opportunities for the establishment of electrified truck stops as "an effective diesel reduction strategy for Connecticut's on-road fleets." In addition, the 2007 New Haven Port Authority Strategic Land Use Plan, citing problems with trucks idling along streets in residential neighborhoods of the port district, recommended that the city "Continue Work to Reduce Vehicular Impacts in the Port District and Community by (a) Reducing the Amount of Truck Idling Times while Waiting to Deliver or Receive Loads . . ." That strategic land use plan is posted at http://www.cityofnewhaven.com/uploads/LandUsePlan.pdf. To address this idling issue, New Haven installed a 14-space electrified parking lot within the Port District to accommodate trucks that were awaiting entry into Port terminals. These TSE units will allow truck drivers to have heat, air conditioning and electricity for in-cab appliances without idling their truck engines. This will relieve a

long-standing idling problem in the neighborhood and provide immediate air quality benefits. While the original intent was that the facility would be available for drayage trucks serving the port, the site's proximity to I-95 could extend use to long-haul truck drivers passing through the state. Both the manufacture and installation of the electrification units created jobs in Connecticut.

It was anticipated that utilizing TSE for drayage truck idling would demonstrate the ability of the most modern TSE technology to accommodate short term, rapid turnover parking. Traditionally TSE facilities have been promoted for their benefits in reducing the long-term idling associated with overnight parking by long-haul trucks. The new TSE units can allow for the short turnaround times that are required for drayage trucks to take advantage of this idle reduction technology; and the layout of this parking area was designed to allow trucks to enter and exit quickly.

Providence & Worcester Rail Road (PWRR) Locomotive Repower: PWRR became unable to provide matching funds and had to withdraw from this program. CSX, which had originally applied for ARRA/DERA funding for a locomotive repower project, was contacted as a potential, alternate recipient, but was unable to participate within the budget that had been allocated for PWRR. On August 10, 2010, the contract with PWRR for the locomotive gen-set conversion project was terminated. DEEP conducted a competitive solicitation for alternative projects and a one-year no cost time extension (NCTE) was granted by EPA to accommodate this selection process and to complete the replacement project.

Cross Sound Ferry Services (CSF) Marine Engine Upgrade Project: On June 17, 2010, DEEP solicited proposals for projects for replace the PWRR locomotive repower project. A wide range of stakeholders that had previously been involved in diesel emission reduction and climate change projects were contacted. From the four proposals submitted, DEEP selected and, in September of 2010, EPA approved a project to upgrade the propulsion engines of the CSF vessel, the *MV Susan Anne*, from Tier 0 to Tier 2, the best control level available for these engines. This was the first ferry in the nation to receive a Tier 2 marine engine upgrade.

The *MV Susan Anne* was built in 1964. This project is an early upgrade of the engines as the engines were not scheduled for maintenance rebuilds until 2016 for the starboard engine and 2014 for the port engine. Upgrading these two large (2300 hp) engines with EPA Certified Tier 2 engine conversion kits provided a significant emissions reduction. In addition to the emissions reductions projected by EPA's diesel emissions quantifier (DEQ), other technologies, including electronic starters and keel coolers will improve fuel economy and reduce emissions of greenhouse gases (GHGs) even further.

The CSF proposal originally called for $750,000 of ARRA/DERA funds from this grant, to be applied toward the cost of the kits, in combination with $250,000 in funds from Connecticut's State DERA grant #DS-97195401-4, to be applied toward the cost of installation. CSF committed to contribute an additional $250,000.00 to the project through a combination of cash in-kind services. The contract between DEEP and CSF to implement this project was executed on December 2, 2010.

Progress on the CSF Marine Engine Upgrade Project was delayed during EPA's review of the upgrade kit vendor's sole source status. On February 3, 2011, EPA approved the selection of Marine Systems, Inc. (MSI) as a sole source vendor for the only EPA-certified upgrade kit compatible with the *MV Susan Anne's* engines. MSI submitted the required competitive pricing documentation, but the upgrade kit costs were higher than initially expected, leading to further delays in the procurement process. A revision to the contract between DEEP and CSF was executed on July 5, 2011. DEEP filed and EPA approved an NCTE to allow time needed for the delivery and installation of the upgrade

kits. The approved NCTE request also included a budget revision to allow the reprogramming of unspent funds from the ConnDOT construction equipment retrofit project to the CSF *MV Susan Anne* marine engine upgrade project, bringing the total from this grant to $768,865.00 with CSF contributing additional funds to bring their total contribution to $312,250.82.

Provide a narrative discussion of the actual project results (outputs and outcomes) and how the results are quantified. These may include, but are not limited to:

- Emission Reductions, Cost Effectiveness and Diesel Fuel Saved, as shown in Table 2 above;
- Health benefits achieved (health benefits may be measured by numbers of illnesses (e.g. reductions in the number of children with asthma, health care costs, or missed work/school days avoided);
- Documented improved ambient air quality;
- Sub-recipient information (name, award amount, project description);
- Vendor information (name, payment amount, good/services provided);
- Number of individual jobs preserved and/or created working directly on the project;
- An increased understanding of the environmental or economic effectiveness of the implemented technology;
- Dissemination of the project information and increased knowledge via list serves, websites, journals, and press/outreach events (provide web links where applicable);
- Widespread adoption of the implemented technology;
- Assisting those most impacted by the current economic conditions;
- Providing investments needed to increase economic efficiency by spurring technological advances in science and health;
- Investment in transportation, environmental protection and other activities that will provide long-term economic benefits including jobs created/retained.
- Other

- **Number of replaced or retrofitted engines/vehicles/equipment:**
  - ConnDOT retrofitted 149 of its vehicles with diesel oxidation catalysts (DOCs). A total of 19 pieces of construction equipment were retrofitted with DOCs and five more were retrofitted with diesel particulate filters (DPFs).
  - The two propulsion engines on the ferry, *MV Susan Anne*, were upgraded from Tier 0 to Tier 2 using EPA-certified upgrade kits.
  - A 14-unit truck stop electrification (TSE) facility was established at the Port of New Haven.

- **Emission Reductions, Cost Effectiveness and Diesel Fuel Saved, as shown in Table 2 above:** The environmental benefits resulting from the retrofits, engine upgrades and TSE facility were calculated using EPA's DEQ whenever possible; with some hand calculations based on DEQ-generated baseline data, and are compiled below in Table 3. Any assumptions that were made when entering data into the DEQ are included in footnotes below the table.

  The manufacturer of the marine engine upgrade kits projects a 2% decrease in fuel usage, for a savings of 5,758 gallons of diesel fuel per year from the CSF Marine Engine Upgrade Project. Depending on usage, the diesel fuel savings from the New Haven TSE facility are projected to be up to 15,288 gallons per year, using the assumptions footnoted in Table 3.

- **Health benefits achieved (health benefits may be measured by numbers of illnesses (e.g. reductions in the number of children with asthma), health care costs, or missed work/school days avoided):** The DEQ projects the annual health benefits for the ConnDOT Retrofit Project to be $970,000.00, and for the New Haven TSE facility to be up to $180,000.00, depending on usage. The DEQ is not currently able to make health benefits projections for marine engine upgrades. The total health benefits from this grant were projected to be a minimum of $1,150,000 per year, without including the benefits of the cleaner engines on the ferry.

Table 3: Potential Lifetime Cost Effectiveness of Connecticut ARRA/DERA Grant

149 DOCs on ConnDOT Trucks, 19 DOCs & 5 DPFs on Highway Construction Equipment Health Benefits: $970,000/yr					
	NO_X	**PM**	**HC**	**CO**	**CO_2**
Amount Reduced Lifetime (tons)	0	4.7628	17.0647	46.8316	0
Capital Cost Effectiveness ($/ton)[1]	0	$76,551	$26,366	$7,785	0
Total Cost Effectiveness ($/ton)[2,8]	0	$82,866	$23,128	$8,428	0
Marine Engine Upgrade CSF *MV Susan Anne* Fuel Savings: 5,758 gal/yr					
	NO_X	**PM**	**HC**	**CO**	**CO_2**
Amount Reduced Lifetime (tons)	719.3877[3]	22.4573[3]	See note[3]	157.6915[3]	958.7070[3]
Capital Cost Effectiveness ($/ton)	$1,508	$48,312		$6,880.57	$1,132
Total Cost Effectiveness ($/ton)[8]	$1,892	$60,613		$8,632	$1,420
Lifetime Reductions from this Grant[4]	542.8500	16.9463	See note[3]	118.9940	723.4403
Capital Cost Effectiveness, this Grant[1,5] ($/ton)	$1,416	$45,371		$6,461	$1,063
Total Cost Effectiveness, this Grant[2,5,8] ($/ton)	$1,472	$47,146		$6,714	$1,104
Port of New Haven Truck Stop Electrification[6] Health Benefits: $180,000 /yr Diesel Fuel Saved: 15,288 gal/yr					
	NO_X	**PM**	**HC**	**CO**	**CO_2**
Amount Reduced Lifetime (tons)[6]	55.9876	1.5961	See note[7]	See note[7]	2,884.8456
Capital Cost Effectiveness ($/ton)[1]	$5,987	$210,017			$116
Total Cost Effectiveness,[2,8] ($/ton)	$6,895	$241,861			$134
Total Lifetime Cost Effectiveness, This Grant					
	NO_X	**PM**	**HC**	**CO**	**CO_2**
Reductions from this Grant (tons)	598.8376	23.3052	17.0647	165.8256	3,608.2859
Capital Cost Effectiveness, this Grant ($/ton)[1]	$2,453	$63,018	$86,064	$8,857	$407
Total Cost Effectiveness, this Grant ($/ton)[2,9]	$2,638	$67,782	$92,569	$9,526	$438

[1]Capital Cost Effectiveness, as defined in EPA's DEQ User's Guide, is calculated by dividing the total unit and installation costs of all retrofits[/upgrades/TSE units] in the fleet by the Amount Reduced.

[2] Total Cost Effectiveness, as defined in EPA's DEQ User's Guide, is calculated by dividing the total cost of the retrofit project (capital costs, administrative costs, etc.) by the Amount Reduced. In this calculation, any emission increases from control technologies are not included in the Amount Reduced.

[3]Based on engineering estimates provided by the manufacturer of the marine engine upgrade kits; these did not include any projected reductions in HC.

[4]Allocation based on having 75.46% of the project's Federal funding coming from this State ARRA/DERA grant; therefore 75.46% of emissions benefits are credited to this grant.

[5]Of a total of $1,331,115.82 for the project, $768,865.00 was allocated from this grant and applied towards the cost of the upgrade kits, without installation or any administrative expenses.

[6] Emissions reductions depend upon usage of facility and cannot be determined until a pattern of usage is established. To establish fleet data for the DEQ, numbers are based on the estimated short-term usage by short haul drayage trucks serving the port as follows: each of the 14 units potentially accommodates 4 trucks @ 1.5 hours/day (turnaround time 0.5 hr/truck to park, pay, attach unit and detach unit), 5 days/week, 52 weeks/year.

[7]While idle reduction decreases emissions of all pollutants, the DEQ does not calculate reductions of HC and CO for idle reduction technologies.

[8] Includes 1/3 of DEEP Administration costs in each project: $90,009 ÷ 3 = $30,003

[9]Project Total Cost includes DEEP administration expenses: personnel, fringe benefits, indirect charges, etc.

- **Documented improved ambient air quality:** With all of the retrofitted ConnDOT trucks deployed statewide, the strong influence of transported air pollution in Connecticut would make any incremental improvement in air quality resulting from the emission controls extremely difficult to differentiate. Air quality improvements resulting from the retrofitted construction equipment being used on new highway construction projects would be similarly difficult to identify. Neither the upgraded ferry nor the TSE facility was put into full use before the end of the grant period, so improvements were not available to be documented. Once all of these improvements are put into service, they will be contributing to DEEP's overall objective to decrease diesel emissions as part of a balanced strategy to attain the National Ambient Air Quality Standards.

- **Sub-recipient information (name, award amount, project description):**
  - The Connecticut Department of Transportation (ConnDOT) received $364,597.66 to retrofit 149 maintenance trucks and 24 pieces of construction equipment.
  - The City of New Haven received $355,963.81 to establish a 14-unit TSE facility.
  - Cross Sound Ferry Services received $768,865.00 from this grant to help pay for the marine engine upgrade kits.

- **Vendor information (name, payment amount, good/services provided):**
  - Cummins Power Systems was paid $166,135.00 for purchase and installation of DOCs on 149 ConnDOT maintenance trucks.
  - CabAire was paid $220,297.00 for purchase and installation of 14 electrified truck stop units in New Haven.
  - Laydon Industries was paid $117.105.43 for site preparation and paving at the New Haven TSE facility.
  - Marine Systems, Inc. was paid $768,865.00 toward the cost of the engine upgrade kits for the *MV Susan Anne*.

- **Number of individual jobs preserved and/or created working directly on the project:** A total of 8.57 FTE jobs were created or retained through the projects funded by this grant.

- **An increased understanding of the environmental or economic effectiveness of the implemented technology:**
  - A press release issued in December of 2010, promoted the fact that the *MV Susan Anne* was the first ferry in the nation to receive a state-of-the-art upgrade to its two main engines, bringing them to the cleanest level available for marine engines. The projected cost effectiveness of this successful project can lead to expanded use of marine engine upgrade projects to reduce diesel emissions in the state.
  - The ConnDOT retrofit project expanded the number of highway construction contractors familiar with emissions control technologies and their environmental benefits.
  - Press coverage of the opening of the TSE facility on June 9, 2011, served to inform the public and state and local officials of the benefits of this technology. And the City of New Haven printed information cards, a copy of which appears as Attachment C, for distribution to truckers in the area, introducing them to the fuel savings and other benefits of the anti-idling technology available at the TSE facility.

- **Dissemination of the project information and increased knowledge via list serves, websites, journals, and press/outreach events (provide web links where applicable):**
  - At the beginning of the program, DEEP established a web site dedicated to ARRA-funded

grants, including this Diesel Emission Reduction Act Grant. It can be accessed via http://www.ct.gov/dep/cwp/view.asp?a=2688&Q=437780&depNav_GID=1511.

- Information about these projects also appears on the State of Connecticut's official climate change website, administered by the Governor's Steering Committee on Climate Change. The ARRA/DERA grant information can be found at: http://ctclimatechange.com/index.php/american-recovery-and-reinvestment-act/ .
- On March 22, 2009, then Governor Rell issued a press release concerning DEEP's ARRA/DERA grant application. It can be found at this link: http://www.ct.gov/governorrell/cwp/view.asp?A=3675&Q=437080 .
- On December 31, 2009, then Governor Rell issued a press release on the ConnDOT Retrofit Project, "DOT Snow Plows Now Environmentally Friendly." While the original press release cited in the Third Quarterly Programmatic Report is no longer available on the website, it was published in the Middletown Press and can be found at http://www.middletownpress.com/articles/2010/01/06/news/doc4b43fcda0a488108920654.txt
- The ConnDOT Retrofit Project was featured on the Governor's CT Recovery Spotlight page for the week of June 28, 2010, at: http://www.ct.gov/recovery/cwp/view.asp?a=3704&q=462202.
- The City of New Haven organized a ground-breaking ceremony for the New Haven TSE Project on June 10, 2010. The article from the New Haven Independent can be found at: http://newhavenindependent.org/index.php/archives/entry/the_truck_pollution_stops_here/ .
- On June 17, 2010, DEEP sent a letter to clean diesel and climate change stakeholders in Connecticut soliciting proposals for new projects that could replace the PWRR repower project, or could be funded by the State DERA grant. Proposals were due July 8, 2010. The letter and form were posted on the DEEP website at: http://www.ct.gov/dep/cwp/view.asp?a=2688&q=438552&depNav_GID=1511.
- On December 21, 2010, DEEP issued a press release to announce the CSF engine upgrade project. The press release and an article in the New London Day can be found at http://www.ct.gov/dep/cwp/view.asp?A=3847&Q=470362 and http://www.theday.com/article/20101222/BIZ02/312229922/-1/BIZ .
- An article on sustainability projects in New Haven appeared in the Winter 2011 edition of DEEP's P2 View on-line newsletter. The TSE project was mentioned. The newsletter can be accessed at http://www.ct.gov/dep/lib/dep/p2/newsletter/p2viewwinter11.pdf .
- A publicity event took place on June 9, 2011, to celebrate the New Haven TSE Project. It was held at the nearly completed facility and also featured three pieces of construction equipment that had been retrofitted under the ConnDOT Construction Retrofit Project. The event was covered by local television stations and the New Haven Register; articles about the event were posted on the DEEP website. Two of those articles can be found at: http://www.nhregister.com/articles/2011/06/10/news/new_haven/doc4df176a3cd5ca004012175.txt and http://www.ct.gov/dep/cwp/view.asp?Q=480884&A=4013. The publicity event was also covered in the June 2011 edition of the US Department of Energy's electronic newsletter, National Idling Reduction Network News at http://www1.eere.energy.gov/vehiclesandfuels/pdfs/idling_news/june11_network_news.pdf and in two of DEEP's new on-line newsletters at http://archive.constantcontact.com/fs031/1104335014923/archive/1106414410981.html and http://archive.constantcontact.com/fs031/1104335014923/archive/1105981612605.html.
- New Haven posted information about the TSE Facility on its website at: http://www.cityofnewhaven.com/PortAuthority/PressNews/.
- The Port of New Haven TSE facility is listed with other TSE facilities, nationwide, on the U.S. Department of Energy's "Energy Efficiency and Renewable Energy" website at: http://www.afdc.energy.gov/afdc/progs/tse_listings.php.

- **Widespread adoption of the implemented technology**:
  - The cost saving and emissions reduction success of the first ferry engine upgrade project to use Tier 2 upgrade kits may lead to additional improvements from similar upgrades on other ferries.
  - One of the purposes of the ConnDOT sub-grant was to increase the number of pieces of retrofitted highway construction equipment so that more would be available for use in other regional and state projects in the future. The contracts for the New-Britain-Hartford Busway project, which is scheduled to begin in 2012, have incorporated diesel emission reduction specifications as have the contracts for multiple projects associated with the Metro-North/Shoreline-East Rail Station in Westbook, CT.
  - ConnDOT was sufficiently impressed with the DOCs installed on 29 of its trucks with funding from DERA Grant #DE 97199001, that it applied for and was awarded funds from this grant to install DOCs on its entire fleet of maintenance/snowplowing trucks, an additional 149 vehicles.

- **Increased understanding of project and results:**
  - **ConnDOT Retrofit Project:** When the entire fleet of ConnDOT maintenance trucks had been retrofitted, then Governor Rell issued a press release. The link below is to an article resulting from that press release. http://www.middletownpress.com/articles/2010/01/06/news/doc4b43fcda0a488108920654.txt?viewmode=fullstory
  - **CSF Marine Engine Upgrade Project:** On December 21, 2010, DEEP issued a press release to announce the CSF engine upgrade project. The press release can be found at http://www.ct.gov/dep/cwp/view.asp?A=3847&Q=470362.
  - **Port of New Haven TSE Project:** A publicity event took place on June 9, 2011, to celebrate the New Haven TSE Project. It was held at the nearly completed facility and also featured three pieces of construction equipment that had been retrofitted under the ConnDOT Construction Retrofit Project. The event was covered by local television stations and the New Haven Register; articles about the event were posted on the DEEP website.

- **Assisting those most impacted by the current economic conditions:**
  - Independent drayage truck operators serving the Port of New Haven, which are mostly small businesses, will be able to cut their fuel costs by using the electrified truck stop instead of idling their engines for heat and air conditioning. The drivers will also share the health benefits of reduced exposure to diesel emissions.
  - Reducing diesel pollution in the Environmental Justice community situated between I-95 and the port will improve the health of those who live and work there, lowering the direct costs of health care and the indirect costs from missing work and school time.
  - CSF will benefit from the fuel savings resulting from the engine upgrade and the passengers and crew of the *MV Susan Anne* will share in the health benefits from reduced emissions.

- **Providing investments needed to increase economic efficiency by spurring technological advances in science and health:** Not applicable

- **Investment in transportation, environmental protection and other activities that will provide long-term economic benefits including jobs created/retained:**
  - The truck stop electrification facility at the Port of New Haven will continue to provide truck operators with the opportunity to save diesel fuel while maintaining cab comfort by plugging

into the TSE units instead of idling their engines to operate heaters or air conditioners.
  - The owners of construction equipment retrofitted under the ConnDOT Construction Equipment Retrofit Project will be able to better compete for future projects for which clean diesel contract specifications must be met.
  - The reduction in exposure to diesel emissions in the neighborhood of the TSE will have economic benefits from improved health for those who live and work there, reducing the direct costs of health care and the indirect costs from missing work and school time.
  - Since ferry engines have long expected lifetimes, CSF will continue to reap the financial benefits of improved fuel economy stemming from the upgraded engines.
  - A total of 8.57 FTE jobs were created or retained through the projects funded by this grant.

- **Other:** Not Applicable

Provide a summary of the proposed outputs and outcomes as listed in the approved project Work Plan. Provide a comparison of actual results with the proposed outputs/outcomes specified in the approved project Work Plan. Explain the reason for any differences in proposed versus actual outputs/outcomes.

Outputs:

- **ConnDOT Retrofit Project**: This project resulted in 149 on-road vehicles being retrofitted with diesel oxidation catalysts (DOCs) along with 19 pieces of construction equipment; five more pieces of construction equipment were retrofitted with DPFs. The total of 173 retrofits exceeded the projection of 170 retrofits but only $364,597.66 of the allocated $491,135.00 was spent. Approximately 4.76 tons of particulate matter (PM) will be reduced over the lifetimes of the equipment, with a capital cost-effectiveness of $76,511.00/ton.
- **Port of New Haven TSE Project**: Seven CabAire kiosks, with 14 TSE units, were installed at the corner of Stiles and Alabama Streets near the Port of New Haven. The larger property originally selected for this facility would have accommodated 20 TSE units, but that parcel was reserved for another use and became unavailable. The decrease in the number of units, combined with a lower than projected contract costs for site preparation, resulted in the completion of this project using only $355,963.81 of the $380, 256.00 initially allocated. This facility has the capacity to reduce 1.60 tons of PM over the lifetime of the facility with a capital cost effectiveness of $210,017.00/ton, depending upon usage. This project can also reduce up to 55.99 tons of nitrogen oxides, which are precursors of the criteria pollutant, ozone, with a capital cost effectiveness of $5,987.00/ton.
- **PWRR Locomotive Repower:** Because PWRR became unable to provide matching funds, they withdrew from this program. Following a competitive selection process, this project was replaced by the CSF Marine Engine Upgrade Project.
- **CSF Marine Engine Upgrade Project**: The two propulsion engines for the Ferry, *MV Susan Anne*, were upgraded from a pre-regulation Tier 0 to Tier 2 using EPA-certified marine engine upgrade kits. Initially, this grant was to have provided $750,000.00 toward the purchase of the upgrade kits. During the extended contracting process, the cost of the kits increased. With EPA approval, DEEP was able to use some of the uncommitted funds from the ConnDOT Retrofit Project to increase this project's allocation to $768,865.00. Over the lifetime of this vessel, PM emissions are projected to be decreased by 16.95 tons with a capital cost effectiveness of $45,371.00/ton from this grant or 22.46 tons overall, with a capital cost effectiveness of $48,312.00/ton. The reductions of NO_X are even more impressive with an overall lifetime reduction of 719 tons at a capital cost of $1,508/ton.

Outcomes:

- **Short term outcomes:**
  - **ConnDOT Construction Retrofit Project:** This project built on a previous DERA-funded retrofit project for ConnDOT trucks, which had raised awareness of the air quality and health benefits of retrofit technology. This led to ConnDOT's plans to retrofit more of its fleet, provide retrofits for its contractors and to expand the use of clean diesel specifications on contracts beyond the Q Bridge, for which they were originally developed. ConnDOT's New Britain/Hartford Busway Project, scheduled to begin construction in 2012, will include clean diesel specifications.
  - **Port of New Haven TSE Project:** Every truck operator who uses the TSE facility will realize an immediate economic benefit from the savings for fuel not burned by idling. The DEQ projects that 1.05 gallons of diesel fuel will be saved for every hour of reduced idling,
  - **CSF Marine Engine Upgrade Project:** The improved fuel efficiency of the upgraded engines on the *MV Susan Anne* is projected to be 2%. At the current activity rate, that can save 15 gallons of diesel fuel each day, resulting in a significant economic benefit to CSF.
  - **All Projects:** The reduction of diesel pollution results in immediate air quality and health benefits. While there are significant health benefits that are long-term outcomes, some health benefits begin to accrue more rapidly. With decreases in exposure to PM, persons who suffer from asthma, bronchitis, chronic obstructive pulmonary disease (COPD) and similar conditions are apt to experience fewer episodes, resulting in fewer missed school and work days and fewer trips to the doctor or emergency room; this is a short-term economic benefit.
- **Medium-term outcomes:**
  - Air quality and health benefits continue as medium-term outcomes, with the economic benefits of improved work and school attendance. The total health benefits from the project are projected to be a minimum of $1,150,000 per year without including the benefits of the cleaner engines on the ferry.
  - The owners of construction equipment retrofitted under the ConnDOT Construction Retrofit Project will contribute to improving air quality and will reap the economic benefits of keeping their equipment operators employed on future projects for which clean diesel specifications may be in force. For example, the contractors who participated in this grant program will be able to meet clean diesel requirements should they submit successful bids on portions of the New Britain/Hartford Busway, the Metro-North/Shoreline-East Rail Station in Westbook, CT, and similar projects in the future.
  - DEEP obtained projections of the costs and benefits of the technologies involved in these diverse programs. DEEP is using this information in selecting projects, through competitive solicitations, for State DERA funding.
- **Long-term outcomes:**
  - Over the lifetimes of the equipment involved in these projects, there is a estimated decrease in PM emissions of 23.31 tons, a decrease in nitrogen oxides, which are ozone precursors, of 598.84 tons, and a decrease in the greenhouse gas, carbon dioxide, of 3,608.29 tons.
  - Reductions in exposure to PM and ozone can lead to long term health benefits resulting from fewer incidents of cardiopulmonary disease, bronchitis, asthma and cancer.
  - The idle reduction made possible by the TSE facility will save fuel and promote energy independence.
  - The cumulative impact of the short term emissions reductions from these projects leads to improvement in Connecticut's air quality and the health of its residents, a decreasing the

incidents of asthma and other conditions related to diesel pollution. We have not reached a point where long term benefits can be fully assessed, but all the retrofitted vehicles, upgraded engines and TSE units are still in service and continue to provide reduced emissions that will benefit state and regional air quality for years to come.

Provide a narrative discussion of the successes and lessons learned for the entire project.

ConnDOT Retrofit Project: This sub-grant provided more retrofits than initially projected, for less money than originally projected and was completed well ahead of the end of the grant period. That constitutes success by any measure. The retrofitted ConnDOT trucks were used for snowplowing, without any problems, through the record snowfall winter of 2010-2011 and the devices remain on all of the active trucks initially retrofitted, though three retrofitted trucks have been retired for reasons unrelated to the DOC mufflers. ConnDOT is very satisfied with the technology.

The most significant lesson learned from this project is that retrofitting construction equipment has great air quality benefits and can be remarkably cost effective. As is illustrated in Table 4 below, installing DOCs on construction equipment is the most cost effective means of reducing particulate matter (PM) that DEEP has encountered to date; 19 retrofits reduced 1.88 tons of PM with a cost effectiveness of only $35,414 per ton reduced. By contrast, the high cost of DPFs makes that technology much less cost effective, even though the PM reductions per unit are substantially greater. In this project, five DPFs, costing twice as much as the 19 DOCs, are projected to reduce 1.18 tons of PM, at a cost of $112, 077 per ton reduced. Even so, despite the relatively high cost effectiveness of the DPFs, the combined cost effectiveness of retrofitting 24 pieces of construction equipment was remained $64,872 per ton of PM reduced.

In the second lesson, DEEP reconfirmed a demonstration, from the State DERA-funded Connecticut Clean School Bus Program and the NEDC Maintenance Vehicle Project, funded by National DERA Grant #DE-97199001-2, that a large number of retrofits with DOCs, which individually remove less particulate matter but are less expensive than DPFs, can be cost-effective in reducing significant amounts of particulate matter from on-road vehicles. Using the most recent version of the DEQ, the cost effectiveness of reducing 8.39 tons of PM by installing DOCs on 353 school buses has been projected to be $84,017 per ton of PM reduced. Installing DOCs on 149 ConnDOT trucks reduced 1.70 tons of PM with a slightly higher cost effectiveness of $97,522 per ton. However, if the same amount of funds used to retrofit those 149 trucks with DOCs were used to install DPFs on similar trucks, at state contract prices, only 21 trucks could have been retrofitted, reducing 1.02 tons or PM at $164,456 per ton. Clearly, DOCs still have a valuable place in our arsenal of weapons to reduce diesel pollution.

Table 4: Potential Lifetime Cost Effectiveness of ConnDOT Construction Retrofit Sub-Grant

	NO_X	PM	HC	CO	CO_2
149 DOCs on ConnDOT Trucks, 19 DOCs & 5 DPFs on Highway Construction Equipment Health Benefits: $970,000/yr					
Amount Reduced Lifetime (tons)	0	4.7628	17.0647	46.8316	0
Capital Cost Effectiveness ($/ton)	0	$76,551	$21,366	$7,785	0
149 DOCs on ConnDOT Trucks Health Benefits: $140,000/yr					
	NO_X	PM	HC	CO	CO_2
Amount Reduced Lifetime (tons)	0	1.7036	12.4523	31.0783	0
Capital Cost Effectiveness ($/ton)	0	$97,522	$13,342	$5,346	0
19 DOCs & 5 DPFs on Highway Construction Equipment Health Benefits: $840,000					
	NO_X	PM	HC	CO	CO_2
Amount Reduced Lifetime (tons)	0	3.0593	4.6124	15.7534	0
Capital Cost Effectiveness ($/ton)	0	$64,872	$43,028	$12,598	0
5 DPFs on Highway Construction Equipment Health Benefits: $240,000/yr					
	NO_X	PM	HC	CO	CO_2
Amount Reduced Lifetime (tons)	0	1.1756	1.5943	6.6283	0
Capital Cost Effectiveness ($/ton)	0	$112,077	$82,642	$19,877	0
19 DOCs on Highway Construction Equipment Health Benefits: $600,000/yr					
	NO_X	PM	HC	CO	CO_2
Amount Reduced Lifetime (tons)	0	1.8837	3.0181	9.1250	0
Capital Cost Effectiveness ($/ton)	0	$35,414	$22,103	$7,311	0
149 DOCs on ConnDOT Trucks & 19 DOCs on Highway Construction Equipment Health Benefits: $740,000/yr					
	NO_X	PM	HC	CO	CO_2
Amount Reduced Lifetime (tons)	0	3.5873	15.4704	40.2033	0
Capital Cost Effectiveness ($/ton)	0	$64,908	$15,051	$5,792	0

After the ConnDOT retrofit project had been selected by DEEP and approved by EPA, DEEP learned that there were very few DOCs verified for use on construction equipment and those that were verified had limited applications. EPA Region 1 gave approval, for this project only, to use some DOCs, manufactured by Engine Control Systems and verified for freight handling applications, on off-road construction equipment. The engines were to be consistent with model years in the verification and ultra-low sulfur diesel fuel was required to be used, but other limits on the applications for which those DOCs are verified would not apply. Other than the fact that three of the 24 pieces of construction equipment originally targeted to receive DOCs could not be retrofitted due to siteline issues, a common occurrence with construction retrofits, no difficulties were encountered.

Initially, this was proposed as a DOC retrofit program. In the second year, ConnDOT requested and EPA approved the addition of DPFs as emission control technologies for the construction equipment. While few of the contractors elected to receive DPFs, there were enough for DEEP to see the relative benefits and costs of applying this technology to construction equipment.

The greatest success from this project is that there is more retrofitted equipment available to be used on other state and regional construction projects, leading to cleaner air for Connecticut residents. Clean diesel specifications are being included in all of the contracts on the New Britain/Hartford Busway; the first five projects are due to start this spring. And multiple projects associated with the Metro-North/Shoreline-East Rail Station in Westbook, CT, will also include clean diesel contract specifications.

CSF Marine Engine Upgrade Project: While this was the most expensive project that DEEP has funded through the DERA program, it yielded impressive PM reductions with remarkable cost effectiveness. The cost of engine replacements for a boat the size of the *MV Susan Anne* is estimated to be nearly twice the cost of the upgrade, which would have had a serious negative impact on the cost effectiveness. In addition, the fact that the engine upgrade could be accomplished without putting the large vessel in dry dock saved the owners a great deal of time and money, allowing the ferry to be back in operation quickly, an additional economic benefit to this Connecticut business. Thus, the first Tier 2 engine upgrade of a ferry in the United States has been a great success.

The fact that there are relatively few certified upgrade kits compatible with marine engines of this size necessitated a sole source review, which prevented the completion of the project before the 2011 summer season. DEEP sought and received a no cost extension from EPA to allow the engine upgrade to proceed after the ferry's busy summer season. The engine upgrade and successful sea trials were completed in November of 2011, ahead of the extended deadline for the grant.

Port of New Haven TSE Project: The TSE project at the Port of New Haven was conceived to provide short term parking with idle reduction for drayage trucks awaiting their turns in line at the port facilities. This was premised on a determination that the technology was compatible with a short term, fast turnaround operation. The site plan was developed to allow trucks to pull through easily. What did not become apparent until the project was well underway was that the industry has not embraced TSE technology in its original, long term parking format, let alone in the relatively new application envisioned for New Haven. Many reasons for the poor usage rate of TSE facilities have been proposed, but clear conclusions have not been reached. While this facility has been open for only a short time, it is experiencing the same limited use endemic to TSE facilities nationwide.

Truck stop electrification projects were expressly identified as infrastructure projects in the conditions listed in the EPA-initiated Agreement Amendment #2D-96102001-1, dated October 26, 2009. As such, this project was subject to the requirements of the Davis Bacon Act, which include payroll reviews and on-site interviews of construction contractors' employees. Before approving this project, the Governor's office requested that DEEP obtain confirmation from New Haven that it was aware of these requirements and able to comply. Assurances that New Haven had experience with Davis/Bacon on other Federally funded projects allowed the project to go forward. However, due to a determination that New Haven had failed to meet some of the time-sensitive Davis/Bacon requirements, EPA listed Davis Bacon Act compliance as an item in need of correction in the report from its Post-Award Monitoring site visit on July 26, 2011. EPA requested DEEP to prepare a corrective action plan; that plan was approved by EPA on December 5, 2011 and is Attachment D to this report.

Project Administration: DEEP's experience in developing instruments to implement these ARRA/DERA-funded projects has been applied to the development of a number of subsequent Scopes of Work, beginning with the CSF Marine Engine Upgrade project and including five new projects funded by State DERA Grant #DS-97195401-4.

If any cost-share or additional leveraged funds are reported in Table 1 above, identify the source of the funds.
Leveraged funds from Connecticut's State DERA grant #DS-97195401-4 for the CSF Marine Engine Upgrade Project: $250,000 **Cost Shared funds from Cross Sound Ferry Services:** $312,250.82

Was any program income generated during the project period? Identify amount of program income, how it was generated, and how the program income was used.
No
For projects involving vehicle/equipment replacement and repowers provide: **1) Evidence that the replacement activity is an "early replacement," and would not have occurred during the project period through normal attrition (i.e. without the financial assistance provided by EPA). Supporting evidence can include verification that the vehicles or equipment replaced had useful life left and fleet characterization showing fleet age ranges and average turnover rates per the vehicle or fleet owner's budget plan, operating plan, standard procedures, or retirement schedule; and** **2) Evidence of appropriate scrappage or remanufacture, including the engine serial number and/or the vehicle identification number (VIN).**
The *MV Susan Anne* was built in 1964. This project was an early upgrade of the engines as the engines were not scheduled for maintenance rebuilds until 2016 for the starboard engine and 2014 for the port engine. While this project, as an upgrade, did not involve replacement and scrappage on the engines, CSF did provide DEEP with documentation of proper disposal of the replaced engine parts. *Include Attachments as Necessary

For projects that take place in an area affected by, or that include affected vehicles, engines or equipment affected by, Federal, State or local law mandating emissions reductions, provide evidence that emission reductions funded with EPA funds were implemented prior to the effective date of the mandate and/or are in excess of (above and beyond) those required by the applicable mandate.
There were no mandates in place that were impacted by these projects. *Include Attachments as Necessary

If project activities triggered Davis Bacon Terms and Conditions, did all applicable construction solicitation, contracts and sub-agreements include clauses or terms for complying with the Davis-Bacon Act?
Yes

If project activities triggered Davis Bacon Terms and Conditions, did you and/or your subrecipients receive and review certified weekly payroll records per Department of Labor for WH-347 for applicable construction contracts?
Yes

If project activities triggered Buy American Terms and Conditions, did all applicable contracts have provisions for the use of American Iron, Steel and Manufactured Goods when required?
Yes

Additional Information
See **Attachment A: Clean Construction Contract Specifications for DOCs** **Attachment B: Clean Construction Contract Specifications for DPFs** **Attachment C: New Haven TSE Information Flyer** **Attachment D: Davis Bacon Corrective Action Plan**

U. S. Environmental Protection Agency
Project Fleet Description Spreadsheet

Grant #:	**96102001**
Final Report Date:	**30-Apr-12**

Recipient Information

Organization/ Grantee Name	First Name	LastName	JobTitle	Address	City	State	EmailAddress	ZipCode	OfficePhone	OfficePhoneExt
DEEP	Ellen	Pierce	Supervising Environmental Analyst	79 Elm Street	Hartford	CT	ellen.pierce@ct.gov	06106-5127	860-424-3027	

Project 1 Information

Project Name	Organization Performing Project	Target Fleet	Number of Vehicles	City	County	State	Region	Funding Amount	Additional Funding Source	Additional Funding Amount	Public Benefit
ConnDOT Retrofit Project	ConnDOT	Other	Over 170		New Haven & Fairfield for non-road; Statewide for on-highway	CT	1	$364,598			yes

Fleet 1 Information:

Current Vehicle Information															New Vehicle/Technology Information								
Vehicle Type	Target Fleet	Class/ Equipment	Vehicle Count	Engine Make	Engine Model	Engine Model Year	Horsepower (Nonroad Only)	Current Tier Level (Nonroad Only)	Current Standard Level for PM and NOx or NMHC+NOx	Fuel Type	Amount of Fuel Used (gal/year for all engines in this row)	Annual Miles per vehicle (On Highway Only)	Annual Usage Rate Hours per engine (Nonroad Only)	Annual Idling Hours (per engine)	Serial and/or VIN # of scrapped engine and/or vehicle	Year of Retrofit Action	Technology Type	Technology Make	Verified Technology Model	New Engine Model Year (for replacements/ repowers Only)	New Tier Level (Nonroad replacements/rep owers Only)	New Standard Level for PM and NOx or NMHC+NOx	Annual Idling Hours Reduced (per engine)	Technology Unit Cost	Technology Unit Installation Cost
On Highway	Other	Class 7	50	International	DT530	2000	NA	NA	NA	Diesel (ULSD), 15 ppm	85700	12000	NA	200	NA	2009	Diesel Oxidation Catalyst	BASF	CMX Catalyst Muffler	NA	NA	NA	NA	$990	$125
On Highway	Other	Class 7	70	International	DT530	2001	NA	NA	NA	Diesel (ULSD), 15 ppm	119980	12000	NA	200	NA	2009	Diesel Oxidation Catalyst	BASF	CMX Catalyst Muffler	NA	NA	NA	NA	$990	$125
On Highway	Other	Class 7	28	International	DT530	2002	NA	NA	NA	Diesel (ULSD), 15 ppm	47992	12000	NA	200	NA	2009	Diesel Oxidation Catalyst	BASF	CMX Catalyst Muffler	NA	NA	NA	NA	$990	$125
On Highway	Other	Class 7	1	International	DT530	2002	NA	NA	NA	Diesel (ULSD), 15 ppm	1714	12000	NA	200	NA	2010	Diesel Oxidation Catalyst	BASF	CMX Catalyst Muffler	NA	NA	NA	NA	$990	$125
NonRoad	Construction	Tractors/Loaders/Backhoes	1	John Deere	JD Power Tech 4.51	2001	90	Tier 1		Diesel (ULSD), 15 ppm	1472		1135		NA	2011	Diesel Oxidation Catalyst	ECS	Purifier #A16-0130	NA				$1,942.00	$1,831.92
NonRoad	Construction	Other Construction Equipment	1	Caterpillar	3116	1997	152	Tier 1		Diesel (ULSD), 15 ppm	6012		606		NA	2010	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1272	NA				$2,189.00	$2,874.93
NonRoad	Construction	Pavers	1	Cummins	6BT5.9	1998	188	Tier 1		Diesel (ULSD), 15 ppm	2980		821		NA	2011	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1009	NA				$2,189.00	$768.59
NonRoad	Construction	Rollers	1	Cummins	6VT5.9	1999	148	Tier 1		Diesel (ULSD), 15 ppm	2216		760		NA	2010	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1273	NA				$2,189.00	$1,348.92
NonRoad	Construction	Rollers	1	Cummins	4BTA3.9	2002	130	Tier 1		Diesel (ULSD), 15 ppm	2216		760		NA	2011	Diesel Oxidation Catalyst	ECA	Purifier #A16-0130	NA				$1,942.00	$2,574.60
NonRoad	Construction	Excavators	1	Caterpillar	3116	1998	142	Tier 1		Diesel (ULSD), 15 ppm	6063		1092		NA	2011	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1268	NA				$2,189.00	$1,665.49
NonRoad	Construction	Excavators	1	Caterpillar	3176	2000	312	Tier 1		Diesel (ULSD), 15 ppm	6063		1092		NA	2011	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1281	NA				$2,935.00	$2,227.22
NonRoad	Construction	Rubber Tire Loaders	1	Daiwoo	DE08T15	2002	209	Tier 1		Diesel (ULSD), 15 ppm	1472		1135		NA	2010	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1276	NA				$2,424.00	$1,785.07
NonRoad	Construction	Pavers	1	Caterpillar	3116	1996	152	Tier 0		Diesel (ULSD), 15 ppm	2980		821		NA	2011	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1274	NA				$2,189.00	$848.01
NonRoad	Construction	Excavators	2	Caterpillar	3116T	1996	140	Tier 0		Diesel (ULSD), 15 ppm	12126		1092		NA	2010	Diesel Oxidation Catalyst	ECS	Purimuffler #A17 1330	NA				$1,758.00	$1,128.02
NonRoad	Construction	Tractors/Loaders/Backhoes	1	John Deere	JD4045T	2001	96	Tier 1		Diesel (ULSD), 15 ppm	1472		1135		NA	2011	Diesel Oxidation Catalyst	ECS	Purifier #A17-1041	NA				$1,722.00	$300.65
NonRoad	Construction	Rubber Tire Loaders	1	Caterpillar	Cat 3176	2005	259	Tier 2		Diesel (ULSD), 15 ppm	5721		761		NA	2011	Diesel Particulate Filter	DCL	Sootfilter	NA				$16,686.50	$5,735.39
NonRoad	Construction	Excavators	1	Caterpillar	Cat C9	2005	247	Tier 2		Diesel (ULSD), 15 ppm	6063		1092		NA	2011	Diesel Particulate Filter	DCL	Sootfilter	NA				$18,197.60	$6,705.31
NonRoad	Construction	Rubber Tire Loaders	1	Caterpillar	Cat 3176	2005	259	Tier 2		Diesel (ULSD), 15 ppm	5721		761		NA	2011	Diesel Particulate Filter	DCL	Sootfilter	NA				$16,686.50	$4,823.24
NonRoad	Construction	Rubber Tire Loaders	1	Volvo	TD63 KGE	2000	128	Tier 1		Diesel (ULSD), 15 ppm	5721		761		NA	2011	Diesel Particulate Filter	Huss	MK200	NA				$14,285.42	$14,207.77
NonRoad	Construction	Excavators	1	Volvo	Cummins C8.3-3	2001	215	Tier 1		Diesel (ULSD), 15 ppm	6063		1092		NA	2011	Diesel Oxidation Catalyst + Emulsion	Huss	MK300	NA				$18,667.58	$15,759.67

Project 2 Information

Project Name	Organization Performing Project	Target Fleet	Number of Vehicles	City	County	State	Region	Funding Amount	Additional Funding Source	Additional Funding Amount	Public Benefit
New Haven TSE Project	City of New Haven	Other	14 units	New Haven	New Haven	CT	1	$355,964			yes

Fleet 2 Information:

Current Vehicle Information																New Vehicle/Technology Information									
Vehicle Type	Target Fleet	Class/ Equipment	Vehicle Count	Engine Make	Engine Model	Engine Model Year	Horsepower (Nonroad Only)	Current Tier Level (Nonroad Only)	Current Standard Level for PM and NOx or NMHC+NOx	Fuel Type	Amount of Fuel Used (gal/year for all engines in this row)	Annual Miles per vehicle (On Highway Only)	Annual Usage Rate Hours per engine (Nonroad Only)	Annual Idling Hours (per engine)	Serial and/or VIN # of scrapped engine and/or vehicle	Year of Retrofit Action	Technology Type	Technology Make	Verified Technology Model	New Engine Model Year (for replacements/ repowers Only)	New Tier Level (Nonroad replacements/rep owers Only)	New Standard Level for PM and NOx or NMHC+NOx	Annual Idling Hours Reduced (per engine)	Technology Unit Cost	Technology Unit Installation Cost
On Highway	Other		14 TSE units													2011	Truck Stop Electrification	CabAire					Depends upon usage	$220,297.00	$117,105.43

Copy and paste additional lines as necessary to capture project fleet information.

Project 3 Information

Project Name	Organization Performing Project	Target Fleet	Number of Vehicles	City	County	State	Region	Funding Amount	Additional Funding Source	Additional Funding Amount	Additional Funding Source	Additional Funding Amount	Public Benefit

Fleet 3 Information:

Current Vehicle Information																New Vehicle/Technology Information									
Vehicle Type	Target Fleet	Class/ Equipment	Vehicle Count	Engine Make	Engine Model	Engine Model Year	Horsepower (Nonroad Only)	Current Tier Level (Nonroad Only)	Current Standard Level for PM and NOx or NMHC+NOx	Fuel Type	Amount of Fuel Used (gal/year for all engines in this row)	Annual Miles per vehicle (On Highway Only)	Annual Usage Rate Hours per engine (Nonroad Only)	Annual Idling Hours (per engine)	Serial and/or VIN # of scrapped engine and/or vehicle	Year of Retrofit Action	Technology Type	Technology Make	Verified Technology Model	New Engine Model Year (for replacements/ repowers Only)	New Tier Level (Nonroad replacements/rep owers Only)	New Standard Level for PM and NOx or NMHC+NOx	Annual Idling Hours Reduced (per engine)	Technology Unit Cost	Technology Unit Installation Cost

Copy and paste additional lines as necessary to capture project fleet information.

Project 4 Information

Project Name	Organization Performing Project	Target Fleet	Number of Vehicles	City	County	State	Region	Funding Amount	Additional Funding Source	Additional Funding Amount	Public Benefit

Fleet 4 Information:

Current Vehicle Information																New Vehicle/Technology Information									
Vehicle Type	Target Fleet	Class/ Equipment	Vehicle Count	Engine Make	Engine Model	Engine Model Year	Horsepower (Nonroad Only)	Current Tier Level (Nonroad Only)	Current Standard Level for PM and NOx or NMHC+NOx	Fuel Type	Amount of Fuel Used (gal/year for all engines in this row)	Annual Miles per vehicle (On Highway Only)	Annual Usage Rate Hours per engine (Nonroad Only)	Annual Idling Hours (per engine)	Serial and/or VIN # of scrapped engine and/or vehicle	Year of Retrofit Action	Technology Type	Technology Make	Verified Technology Model	New Engine Model Year (for replacements/ repowers Only)	New Tier Level (Nonroad replacements/rep owers Only)	New Standard Level for PM and NOx or NMHC+NOx	Annual Idling Hours Reduced (per engine)	Technology Unit Cost	Technology Unit Installation Cost

Copy and paste additional lines as necessary to capture project fleet information.

Project 5 Information

Project Name	Organization Performing Project	Target Fleet	Number of Vehicles	City	County	State	Region	Funding Amount	Additional Funding Source	Additional Funding Amount	Public Benefit

Fleet 5 Information:

Current Vehicle Information															New Vehicle/Technology Information									
Vehicle Type	Target Fleet	Class/ Equipment	Vehicle Count	Engine Make	Engine Model	Engine Model Year	Horsepower (Nonroad Only)	Current Tier Level (Nonroad Only)	Current Standard Level for PM and NOx or NMHC+NOx	Fuel Type	Amount of Fuel Used (gal/year for all engines in this row)	Annual Miles per vehicle (On Highway Only)	Annual Usage Rate Hours per engine (Nonroad Only)	Annual Idling Hours (per engine)	Serial and/or VIN # of scrapped engine and/or vehicle	Year of Retrofit Action	Technology Type	Technology Make	Verified Technology Model	New Engine Model Year (for replacements/ repowers Only)	New Tier Level (Nonroad replacements/repowers Only)	New Standard Level for PM and NOx or NMHC+NOx	Annual Idling Hours Reduced (per engine)	Technology Unit Cost	Technology Unit Installation Cost

Copy and paste additional lines as necessary to capture project fleet information.

Please replicate the Project and Fleet Information Tables as necessary for additional Projects/Fleets.

U. S. Environmental Protection Agency
Project Fleet Description for Marine Vessels Spreadsheet

Grant #:	**96102001**
Final Report Date:	**30-Apr-12**

Recipient Information **Recipient Information**

Organization/ Grantee Name	FirstName	LastName	JobTitle	Address	City	State	EmailAddress	ZipCode	OfficePhone	OfficePhoneExt
DEEP	Ellen	Pierce	Supervising Environmental Analyst	79 Elm Street	Hartford	CT	ellen.pierce@ct.gov	06106-5127	860-424-3027	

Project 1 Information

ProjectName	Organization Performing Project	TargetFleet	Number of Vehicles	City	County	State	Region	Funding Amount	Additional Funding Source	Additional Funding Amount	Additional Funding Source	Additional Funding Amount	Public Benefit
Susan Anne Marine Engine Upgrade Project	Cross Sound Ferry Services	Marine	1	New London	New London	CT	1	$768,865	State DERA Grant #CT DS97195401	$250,000	CSF	$312,251	yes

Fleet 1 Information for MARINE VESSELS ONLY

Current Vessel Information															New Vessel/Technology Information									
Sector	Application	Total Number of Engines per Vessel (max 5)	Engine Type	Number of Engines	Engine Model Year	Activity Level (Hours per Year per engine)	Horsepower	Annual Idling Hours per engine	Current Tier Level	Current Standard Level for PM and NOx or NMHC+NOx	Displacement per cylinder (Liters)	Current Fuel Type	Amount of Fuel Used (gallons/year per **engine group**)	Year of Retrofit Action	Serial or VIN # of scrapped/replaced engine or vessel	Technology Type	Technology Make	Verified Technology Model	New Engine Model Year (replacements, repowers, and upgrades Only)	Activity Level (hrs/yr per engine - replacements, repowers, and upgrades Only)	Annual Idling Hours Reduced per engine	New Engine Tier Level (replacements, repowers, and upgrades Only)	New Standard Level for PM and NOx or NMHC+NOx	Technology Unit Cost	Technology Unit Installation Cost
Marine	Ferry/Excursion	4	propulsion	1	1977	2000	2300		Tier 0	No limits	5.0<= size <15.0	Diesel (ULSD), 15 ppm	143950	2011	77-H1-151781-F2-1116	Other	EMD	EPA 1042 Kit - Tier 2 Upgrade	2011	2000	NA	Tier 2	PM: 0.21 g/bhp-hr NO_x + THC: 5.82 g/bhp-hr	$1,331,116	Included in technology cost
			propulsion	1	1981	2000	2300		Tier 0	No limits	5.0<= size <15.0	Diesel (ULSD), 15 ppm	143950	2011		Other									
Marine																								
Marine																								
Marine																								
Marine																								

Copy and paste additional lines as necessary to capture project fleet information.

Project 2 Information

ProjectName	Organization Performing Project	TargetFleet	Number of Vehicles	City	County	State	Region	Funding Amount	Additional Funding Source	Additional Funding Amount	Public Benefit
		Marine									

Fleet 2 Information for MARINE VESSELS ONLY

Current Vessel Information															New Vessel/Technology Information									
Sector	Application	Total Number of Engines per Vessel (max 5)	Engine Type	Number of Engines	Engine Model Year	Activity Level (Hours per Year per engine)	Horsepower	Annual Idling Hours per engine	Current Tier Level	Current Standard Level for PM and NOx or NMHC+NOx	Displacement per cylinder (Liters)	Current Fuel Type	Amount of Fuel Used (gallons/year per **engine group**)	Year of Retrofit Action	Serial or VIN # of scrapped/replaced engine or vessel	Technology Type	Technology Make	Verified Technology Model	New Engine Model Year (replacements, repowers, and upgrades Only)	Activity Level (hrs/yr per engine - replacements, repowers, and upgrades Only)	Annual Idling Hours Reduced per engine	New Engine Tier Level (replacements, repowers, and upgrades Only)	New Standard Level for PM and NOx or NMHC+NOx	Technology Unit Cost	Technology Unit Installation Cost
Marine																								
Marine																								
Marine																								
Marine																								
Marine																								
Marine																								

Copy and paste additional lines as necessary to capture project fleet information.

Please replicate the Project and Fleet Information Tables as necessary for additional Projects/Fleets.