# Mack Trucks, Inc.
## Heavy-Duty Diesel Emission Reduction Project

**Prepared by NESCAUM**
**Michael Block, principal author**
**Coralie Cooper**

**June 30, 2005**

### 1. Overview of Programs

This Final Report fulfills a requirement of the consent decree (U.S. v. Mack Trucks, Inc. No. 98-1495) to update EPA on Mack's two consent decree emission reduction projects the "Heavy-Duty Diesel Truck Selective Catalytic Reduction (SCR) Demonstration and In-Use Testing Project along the I95 Corridor" [the "SCR Project"] and the "Heavy-Duty Diesel Truck Aftertreatment Retrofit Project" [the "DOC/DPF Project"]. Both projects started in July of 2000 and were scheduled to be competed by June of 2004. Technical and logistical impediments delayed completion of the projects until the second quarter of 2005 and the submission of this report will close out both projects.

The first of the two projects, the "SCR project", focuses on reducing oxides of nitrogen (NOx) emissions from heavy-duty long haul and vocational trucks. The second project, the diesel oxidation catalyst /diesel particulate filter or "DOC/DPF project" focuses on reducing particulate matter (PM), hydrocarbons (HC), and carbon monoxide (CO) emissions through the installation of DOCs and DPFs predominantly on refuse trucks and a small number of Class 8 line haul trucks.

As part of the SCR project, ten trucks were equipped with SCR systems. Of these ten, eight were long haul, Class 8 tractors from the United Parcel Service (UPS) fleet in Stratford, CT and two were refuse trucks from the Department of Sanitation (DSNY) fleet in New York City. Of these ten trucks, five were also equipped with DPFs as a means of investigating the interactions between SCR and DPF technologies.

As part of the DOC/DPF project, a total of 185 heavy-duty vehicles were targeted for retrofit, including 150 DOCs and 30 DPFs.[1] Table 1 summarizes the truck types and combinations of technologies initially targeted as part of this project, to reduce heavy-duty engine emissions.

| Truck Type & Fleet | Number of DOC retrofits | Number of DPF retrofits | Number of SCR system installations | Number of DPF/SCR combination installations |
|---|---|---|---|---|
| Refuse Truck, WM | 150 | 2 | 0 | 0 |
| Refuse Truck, DSNY | 0 | 28 | 0 | 2 |
| Class 8, UPS | 0 | 0 | 5 | 3 |
| ***TOTALS*** | ***150*** | ***30*** | ***5*** | ***5*** |

Table 1: Summary of Trucks, and Technologies, Initially Targeted for Retrofit

As a result of technological and logistical events during the course of the programs, the number of trucks changed as shown in the following revised table:

[1] As additional 5 DPFs were installed as part of the SCR component of the project for a total of 35 DPFs.

| Truck Type & Fleet | Number of DOC retrofits | Number of DPF retrofits | Number of SCR system installations | Number of DPF/SCR combination installations |
|---|---|---|---|---|
| Refuse Truck, WM | 97 | 2 | 0 | 0 |
| Refuse Truck, DSNY | 55 | 28 | 0 | 2 |
| Class 8, UPS | 0 | 0 | 5 | 3 |
| ***TOTALS*** | 152 | ***30*** | ***5*** | ***5*** |

Table 2: Revised summary of Trucks, and Technologies Retrofitted

A summary of DOC, DPF, SCR and SCR+DPF installations is shown below, with a detailed inventory and assessment of retrofitted trucks may be found in the Appendices at the conclusion of this report.

| INSTALLATION TOTALS: | |
|---|---|
| *Total DOC Installations:* | *152* |
| *Total DPF Installations:* | *30* |
| *Total SCR Installations:* | *5* |
| *Total SCR+DPF Installations:* | *5* |

| Truck Counts for DOC Installations: | |
|---|---|
| Waste Management Trucks: | 97 |
| DSNY Refuse Trucks: | 55 |
| UPS Class 8 Trucks: | 0 |
| *Total DOC Installations:* | *152* |

| Truck Counts for DPF Installations: | |
|---|---|
| Waste Management Trucks: | 2 |
| DSNY Refuse Trucks: | 28 |
| UPS Class 8 Trucks: | 0 |
| *Total DPF Installations:* | *30* |
| Three UPS DPFs subsequently failed and removed | |

| Truck Counts for SCR Installations: | |
|---|---|
| Waste Management Trucks: | 0 |
| DSNY Refuse Trucks: | 0 |
| UPS Class 8 Trucks: | 5 |
| *Total SCR Installations:* | *5* |

| Truck Counts for SCR+DPF Installations: | |
|---|---|
| Waste Management Trucks: | 0 |
| DSNY Refuse Trucks: | 2 |
| UPS Class 8 Trucks: | 3 |
| *Total SCR+DPF Installations:* | *5* |

Table 3: “Per Fleet” Summary of DOC, DPF, SCR and SCR+DPF Installations

## 2. SCR Demonstration Project

### a) Project Partners and Fleets

From an initial list of potential project partners, the following entities ultimately comprised the SCR Project Team:

| Company/Organization | Key Contact(s) | Responsibility |
|---|---|---|
| Mack Trucks, Inc. | Will Miller | Technical & project management; SCR installation; field support; vehicles; funding |
| NESCAUM | Michael Block<br>Coralie Cooper | Overall project management; technical support; retrofit oversight and compliance |
| M.J. Bradley & Associates | Tom Balon<br>Paul Moynihan | Technical and field support; DOC installation documentation |
| Manufacturers of Emissions Controls Association (MECA) | Dale McKinnon | Technical advice |
| Argillon GmBH (formerly Siemens Westinghouse) | Brian Scarnegie | SCR provider; technical support and training |
| Department of Sanitation, New York (DSNY) | Spiro Kattan | Refuse truck fleet for SCR installations; field support; SCR installation documentation |
| United Parcel Service (UPS), Stratford, CT | Dana Johnson | Class 8 truck fleet for SCR installations |
| Fleetguard | Dale Zuhse<br>Larry Olson | Urea provider |

Table 4: SCR Project Partners

As the project progressed, changes in staffing and institutional direction prompted NESCAUM to assume more of the tasks and responsibilities associated with M.J. Bradley & Associates and MECA.

### b) SCR Technology

SCR technology uses urea, which is first converted to ammonia, as the reductant that converts NOx to atmospheric nitrogen and water, as shown in the following figure:

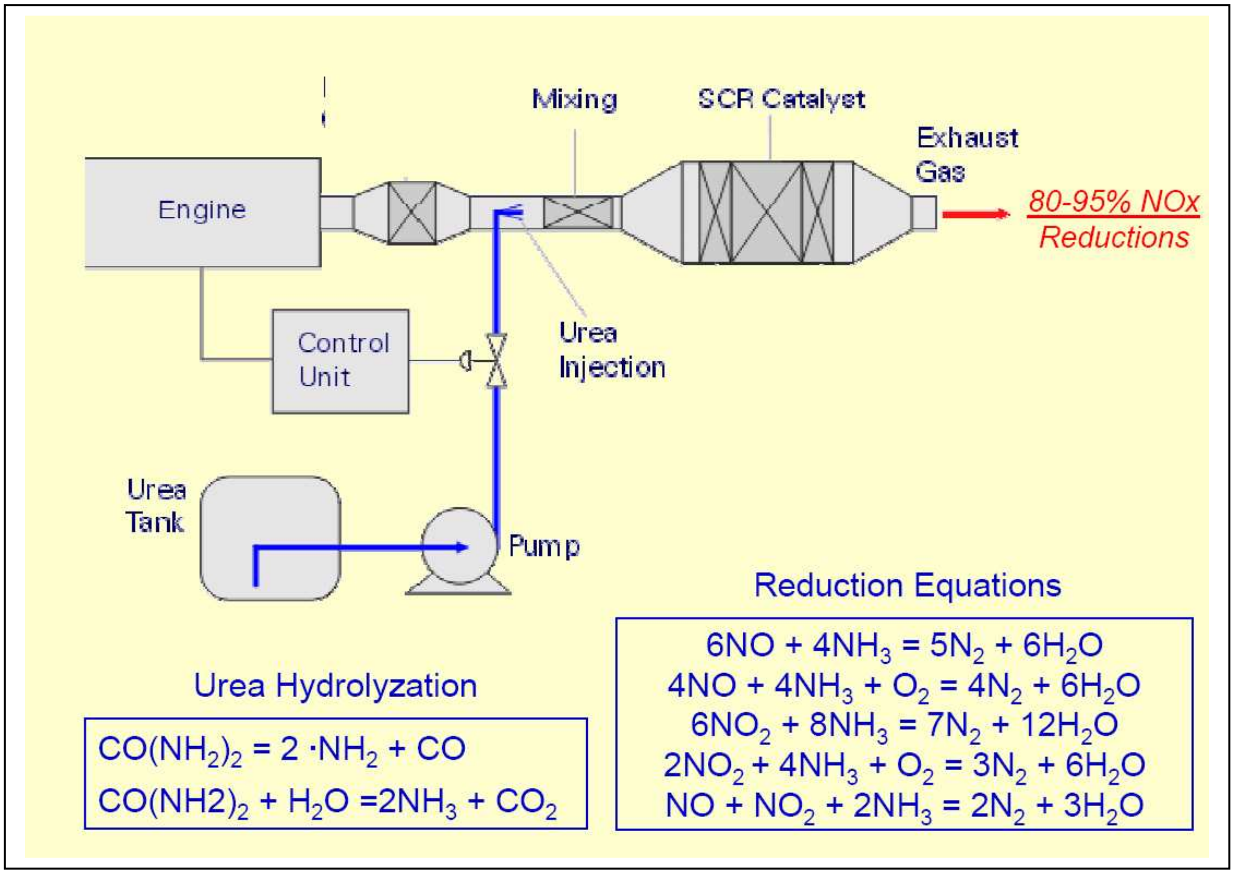



Figure 1: SCR Technology Operating Principle

The Argillon SINOx™ system used in both the DSNY refuse trucks and the UPS Class 8 long-haul trucks operates on the principle shown above, and consists of the following major components:

- Muffler-like design with integrated SINOx™ SCR catalysts
- Urea injection nozzle
- Urea Dosing Control Unit
- SINOx System Electronic Control Unit and software
- Urea storage tank with sensors and integral heater
- 32.5% by weight urea “premix” solution in water

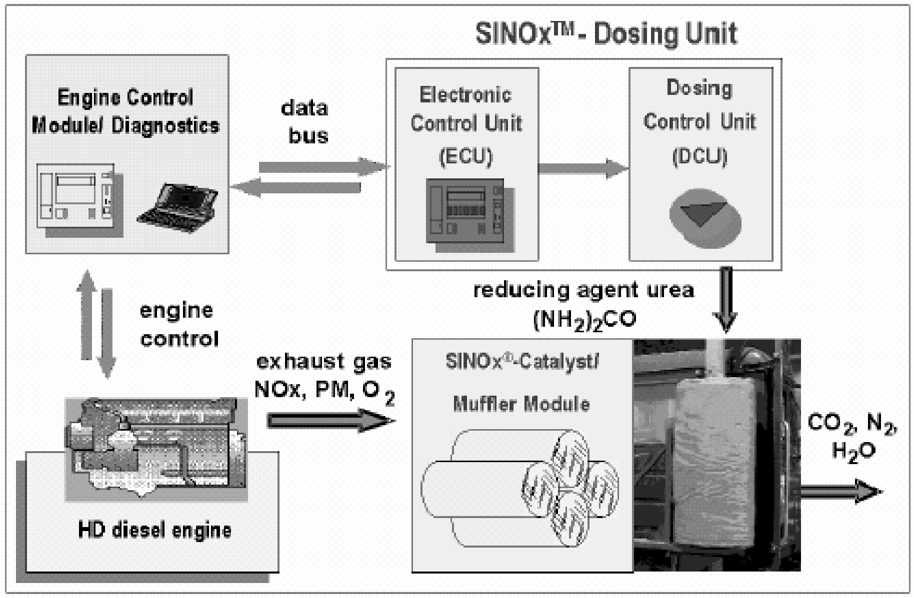



Figure 2: Argillon SINOx™ SCR System Schematic

The SCR catalysts themselves are homogeneous extruded base metal units ($TiO_2$-$V_2O_5$-$WO_3$), with a cell density of 200 cells per square inch (cpsi). The muffler housing for the catalyst itself was constructed from four pieces of round 9.5" diameter canned modules, each 10" in length. The total catalyst volume was 45 liters. A single muffler design was selected to match the single exhaust configuration of both trucks. Dimensionally, this SCR muffler was oval in shape, and measured 14" x 21" x 42".

### c) Installation and Deployment

#### i) DSNY

The SCR units were installed on new refuse trucks at Allentown, PA. These vehicles were completely operational trucks without the Heil-manufactured compactor assembly, which stores and compacts the collected refuse, installed. The trucks were then shipped to a separate facility for compactor assembly installation, and subsequently delivered to DSNY in New York City.

#### ii) UPS

The UPS trucks were first delivered to the UPS facility in Stratford, CT, and entered in to service without any of the SCR units installed, due to the operational needs of UPS. The trucks were subsequently removed for service one truck at a time, and driven to Mack's Allentown truck assembly facility, where the SCR units were installed. The SCR-equipped trucks were subsequently driven back to Stratford, and re-entered into service.

iii) Commissioning – start up problems w/prototype SCR systems

While the SCR system performed well over time, there were a number of significant start-up problems that were not entirely unexpected with these early-design prototype systems. All were resolved through numerous site visits to UPS in Stratford, CT and DSNY in New York City, as part of the commissioning process over an approximately eight months' duration. Specific technical challenges that were addressed during commissioning included:

(1) Urea Leakages – Urea leakages were observed from the exhaust flexible exhaust pipe connections, joints and welds (which typically exhibit a degree of porosity); all were subsequently corrected.
(2) Urea On-Vehicle Storage Tank Sensor – Urea leakage into the sensor and associated wiring harness were observed and corrected.
(3) Sensor Accuracy – Sensors for both the level of urea in the on-vehicle storage tank, and the available pressure in the on-vehicle air pressure system tended to become inaccurate, providing false values.
(4) Urea Debris – Debris was observed in the pumping chamber of the urea pump. The debris was removed, the urea replaced and filters with more stringent filtration capacity installed to rectify the problem. While not definitive, the debris source was adjudged to be from the urea itself, and may have been a contaminated delivery.
(5) Urea Flow Check Valve – The check valve on some vehicles limited urea flow and had to be repaired.
(6) Urea Pressure Regulator – Urea pressure loss over time, stemming from the pressure regulator; had to be corrected.

## d) Attainment of Goals

As enumerated in the October 2002 Interim Report to EPA, the goals of the SCR component of the project were to:

- Reduce NOx emissions from in-use heavy-duty diesel engines in northeast urban, ozone non-attainment areas;
- Assess the effectiveness of the SCR control technology in reducing NOx under both steady state and transient conditions over significant periods of time and mileage accumulation;
- Quantify the emissions reductions achieved from the SCR program;
- Demonstrate prototype emissions measuring devices that gather continuous data on NOx emissions;
- Assess the effectiveness of the system to control secondary emissions such as $N_2O$ and $NH_3$ to minimal levels;
- Develop an understanding of the practical considerations involved in installing SCR technology and a urea infrastructure for in-use highway diesel engines which operate in vocational, over the road or long haul applications.

The SCR component of the program achieved these stated goals. Through comparatively widespread installation of SCR (the most comprehensive in the Northeast to-date), NOx emissions from in-use heavy-duty diesel engines in the region were significantly reduced. This was underscored by the dramatic NOx reductions over protracted periods of in-use operation and mileage accumulation, exhibited in both rounds of testing at West Virginia University (WVU), detailed later in this report. That testing also provided an opportunity for demonstrating prototype emissions measuring devices that gather continuous data on NOx emissions and correlating those data with laboratory instrumentation. Finally, the project served to appreciate the challenges associated with installing SCR technology in these on-highway applications.

$N_2O$ formation was deleted from the project plan since $N_2O$ formation during initial engine dynamometer testing at Southwest Research Institute (SwRI) was minimal, and Argillion is on record that their catalysts formulations exhibit no history of $N_2O$ formation. Deletion of $N_2O$ measurement is detailed in a letter to EPA from Mack Trucks, dated December 21, 2004, and is included in Appendix F.

Development of a urea infrastructure, an initial goal of the project, proved too costly and logistically challenging to implement, and was modified for the program. The initial concept of developing a pilot urea filling infrastructure along selected areas of the I-95 corridor was replaced by site-installed urea filling stations at both SCR fleet sites, in Stratford, CT for UPS, and in New York City for DSNY. Additionally, other studies have investigated the urea infrastructure issue[2], nor does absence of this component of the project influence the effectiveness of urea-based reduction techniques for optimal NOx control.

[2] For example, “SCR-Urea Infrastructure Implementation Final Report, TIAX LLC, July 30, 2003.

## 3. DOC/DPF Demonstration Project

### a) Project Partners and Fleets

From an initial list of potential project partners, the following entities ultimately comprised the DOC/DPF Project Team:

| Company/Organization | Key Contact(s) | Responsibility |
|---|---|---|
| Mack Trucks, Inc. | Will Miller | Technical & project management; SCR installation; field support; vehicles; funding |
| NESCAUM | Michael Block<br>Coralie Cooper | Overall project management; technical support; retrofit oversight and compliance |
| M.J. Bradley & Associates | Tom Balon<br>Paul Moynihan | Technical and field support; DOC installation documentation |
| Manufacturers of Emissions Controls Association (MECA) | Dale McKinnon | Technical advice |
| Engelhard | Kevin Hallstrom | DPF provider; technical support and training |
| Donaldson | Fred Schmidt | DOC provider |
| Waste Management | Paul Gagnon | Fleet provider for DOC installations |
| Department of Sanitation, New York (DSNY) | Spiro Kattan | Refuse truck fleet for DOC, DPF and SCR installations; field support; DOC, DPF and SCR installation documentation |
| United Parcel Service (UPS), Stratford, CT | Dana Johnson | Class 8 truck fleet for DPF and SCR installations |

Table 5: DOC/DPF Project Partners

As with the SCR project, as the project progressed, changes in staffing and institutional direction prompted NESCAUM to assume more of the tasks and responsibilities associated with M.J. Bradley & Associates and MECA.

### b) DOC and DPF Technology

#### i) DOC Technology

DOCs are a low-efficiency/high volume retrofit option at a modest price increase over a conventional muffler. DOCs do not employ physical entrapment of PM, as DPFs do. Rather, they utilize a chemical process and “oxidize”, or “add oxygen” to hydrocarbons in the exhaust, to form carbon dioxide ($CO_2$) and water. Oxygen is present in diesel exhaust in large quantities, so oxidation occurs naturally; a DOC speeds up the reaction rate. The soluble organic fraction (SOF) is the hydrocarbon derivative organic carbon (so called “wet” carbon) portion of PM.

DOCs oxidize the SOF fraction of PM and this reaction results in PM reductions, as shown below:

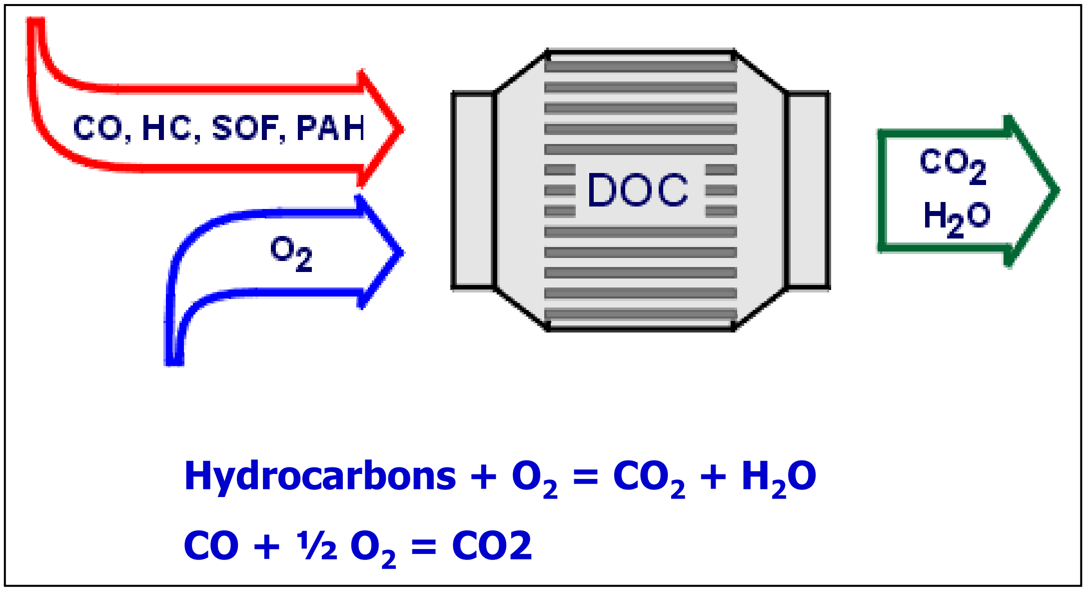



Figure 3: DOC Principle of Operation

### ii) DPF Technology

This project utilized a passive DPF, which requires no outside source of heat for PM regeneration; elevated exhaust temperatures, typical of many diesel-powered heavy-duty vehicles promote regeneration in the DPF through oxidation:

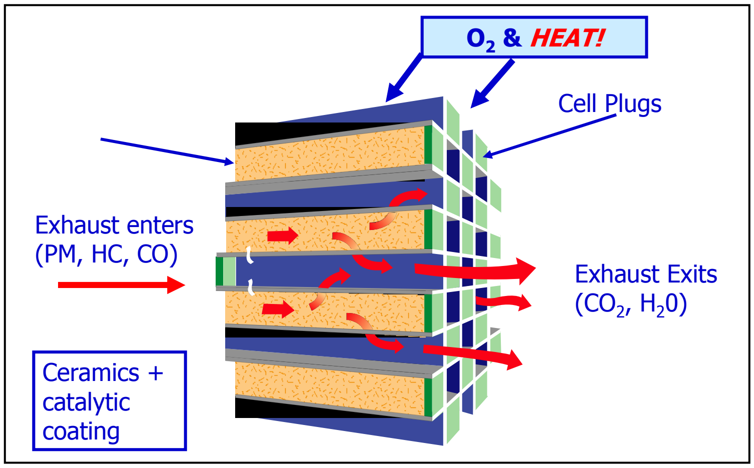



Figure 4: DPF Principle of Operation

By combining a DPF with an oxidation catalyst, the soluble organic fraction (SOF) portion can also be removed, making for impressive total PM reducing efficiency (upwards of 90 percent). The Engelhard DPX® is a passive regeneration DPF design, and was provided with two precious metal loading levels to account for the differing fuel sulfur contents available at UPS and DSNY. The DPF with less catalyst loading was used for the low-sulfur diesel (LSD) Class 8 truck application (nominal 350 ppm, sulfur wt.), while the DPF with greater catalyst loading was used for the DSNY refuse hauler (ULSD). Lower catalyst loading is desirable, when diesel fuel with higher sulfur content is used, to avoid production of sulfate in the exhaust, which from a regulatory perspective, is "counted" as part of the PM content.

The DPF is contained within a single muffler housing, configured much like the SCR. The unit is a wall-flow monolith design incorporating a Cordierite filter. The filter measures 11.25" diameter x 14" length, with 100 cpsi cell density. Typical of most DPF designs, the DPX® incorporates a removal center section to facilitate ash cleaning. Additionally, a "blank" center section, incorporating "muffler-like" baffles, was also provided. It replaced the Cordierite active center section to simulate the "non-DPF" configuration during the testing sequence. (For Round 2, the entire exhaust aftertreatment system was removed to collect true baseline emissions data).

Figure 5: Typical DPF Assembly (filter for DPF, blank for inactive DPF)

### c) Installation and Deployment Results

#### i) DSNY

The DSNY DOC installations were performed by either Bronx or Queens Gabrielli, the local Mack Truck dealer in the New York metropolitan area. One vehicle, 25CN-762, located in Bronx Depot Four, was installed by DSNY at their central repair facility. All DPFs were in stalled by DSNY.

#### ii) WM

The DOCs that were utilized by the six WM fleets[3] were installed through one of three mechanisms: WM mechanics, the local Mack dealer, or for some of the fleets, through a repair service that performed the installations on-site. The three DPFs that were utilized at the WM facility in Londonderry, NH, were all dealer installed, and were subsequently removed by WM personnel at the direction of NESCAUM and Mack, subsequent to observing steadily increasing exhaust backpressure.

[3] Cranston, RI; Londonderry and Rochester, NH; Portland, ME; Somerville and Woburn, MA

d) DPF Failures

Several DPFs had catalytic coatings formulated for compatibility with low sulfur diesel fuel (LSD with 500 ppm maximum sulfur content). Problems were encountered with these DPFs which precipitated their removal due to high exhaust backpressure and resultant substrate failures. Coating deactivation due to fuel sulfur is believed to be the root cause of these problems. Since Waste Management and UPS did not have ULSD fuel available, this theory could not be confirmed. Specific failures included:

- Two vehicles at Waste Management experienced high backpressure due to inadequate passive regeneration; DPFs were removed to prevent engine damage.
- Two vehicles at UPS experienced high backpressure due to filter melting from uncontrolled regeneration. These trucks were towed to dealerships for repair and subsequent DPF removal.
- Two additional vehicles at UPS including replacement of one of the above vehicles experienced high exhaust backpressure; DPFs were removed to avoid further need for truck towing.

In contrast to these experiences using LSD, the DSNY refuse trucks using ULSD and coatings formulated for ULSD, was positive. No failures were reported during the program, and these 30 DPFs will remain in service beyond the conclusion of this project.

Additionally, all the initial DPFs exhibited minor exhaust leaks which were rectified through installation of DPF housing flange gaskets.

**e) Attainment of Goals**

As enumerated in the October 2002 Interim Report to EPA, the goals of the project were to:

- Reduce PM, HC, and CO emissions from in-use heavy-duty diesel engines in northeast urban, ozone and PM non-attainment areas;
- Assess the effectiveness of the DOC and DPF control technologies in reducing pollution over long periods of time;
- Quantify the emissions reductions achieved from the retrofit program;
- Develop an understanding of interactions when combining DPF and SCR technologies in series.

As with the SCR component, the DOC/DPF component of the program achieved the goals, enumerated above. Installation of the DOCs in seven varied geographic areas represented one of the most comprehensive PM (as well as HC and CO) reduction endeavors for the on-highway sector, to-date. In addition to the 55 DSNY refuse trucks, DOCs were installed on 97 Waste Management Trucks in fleets in the following locations: Cranston, RI; Londonderry and Rochester, NH; Portland, ME; Somerville and Woburn, MA.

The in-use DOC emissions testing component of the program was dropped, with the inherent robustness and proven commercialization of this technology providing a very high confidence levels that the DOCs, on a fleetwide basis, provided the PM, HC and CO reductions stated by Engelhard[4], and extensively substantiated in the literature.

While the WVU testing proved inconclusive in quantifying the PM-reduction performance of the DPFs, the combination of SCR with the DPF exhibited no effect upon emissions performance or operational feasibility.

## 4. Revisions to Projects Budget and Schedule

### a) Budget

| | Original Budget | Revised Budget | Difference |
|---|---|---|---|
| SCR Demonstration Project | $1,410,000 | $1,772,000 | + $362,000 |
| DOC/DPF Demonstration Project | $1,310,000 | $998,000 | - $312,000 |
| Totals | $2,720,000 | $2,770,000 | + $50,000 |

Table 6: SCR and DOC/DPF Projects Budget Revisions

[4] See letter to EPA from Mack Trucks entitled “United States v Mack Trucks, Inc., Offset Project Modification,” dated December 21, 2004.

## b) Schedule – SCR Project

### INITIAL SCR PROJECT SCHEDULE

| task | start | end |
|---|---|---|
| project planning | Jul-00 | Aug-00 |
| truck and engine selection | | |
| survey of fleet | Jul-00 | Oct-00 |
| final selection | Oct-00 | Oct-00 |
| truck, engine, and SCR preparation | | |
| engine application testing | Nov-00 | Feb-01 |
| vehicle engineering | Nov-00 | Feb-01 |
| component fabrication | Nov-00 | Apr-01 |
| SCR installation | May-01 | Aug-01 |
| truck delivery | Jul-01 | Oct-01 |
| emissions testing planning | Oct-00 | Jun-01 |
| initial test | Jul-01 | Oct-01 |
| 2nd test - 6 months | Mar-02 | May-02 |
| 3rd test - 12 months | Sep-02 | Nov-02 |
| 4th test - 24 months | Sep-03 | Nov-03 |
| urea filling stations | | |
| site selection | Oct-00 | Feb-01 |
| equipment selection | Nov-00 | Dec-00 |
| pump station fabrication | Jan-01 | Apr-01 |
| installation | May-01 | Oct-01 |
| reports | | |
| report 1 (prepare and deliver) | Jul-01 | Dec-01 |
| report 2 (prepare and deliver) | Jul-02 | Dec-02 |
| final report (prepare and deliver) | Jul-03 | Dec-03 |
| post-test | | |
| certify or remove SCR | Nov-03 | Feb-04 |

### FINAL SCR PROJECT SCHEDULE

| task | start | end |
|---|---|---|
| project planning | Jul-00 | Aug-00 |
| truck and engine selection | | |
| survey of fleet | Jul-00 | Apr-01 |
| final selection | Apr-01 | Apr-01 |
| truck, engine, and SCR preparation | | |
| engine application testing | May-01 | Aug-01 |
| vehicle engineering | Nov-00 | Dec-01 |
| component fabrication | Mar-01 | Dec-01 |
| SCR installation | Sep-01 | Mar-02 |
| truck delivery | Feb-02 | Apr-02 |
| SCR in use at customer sites | Feb-02 | Oct-04 |
| emission testing | | |
| planning | Oct-00 | Dec-01 |
| SwRI cell test | Jun-01 | Aug-01 |
| in-use test 1 | Apr-03 | Apr-03 |
| WVU dyno 1 (after 12 mo) | May-03 | Jun-03 |
| in-use test 2 | Apr-04 | Apr-04 |
| WVU dyno 2 (after 24 mo) | May-04 | Jun-04 |
| urea filling stations | | |
| site selection | May-01 | Jul-01 |
| equipment selection | Nov-00 | Jul-01 |
| pump station fabrication | Aug-01 | Jul-02 |
| installation | Dec-01 | Aug-02 |
| reports | | |
| NESCAUM mid-project | Oct-02 | Oct-02 |
| WVU emissions #1 | Mar-04 | Mar-04 |
| WVU emissions #2 | Mar-05 | Mar-05 |
| NESCAUM final | Jun-05 | Jun-05 |
| post-test | | |
| remove SCR | Jan-05 | Mar-05 |

## c) Schedule – DOC/DPF Project

### INITIAL PM PROJECT SCHEDULE

| task | start | end |
|---|---|---|
| project planning | Jul-00 | Oct-00 |
| truck and engine selection | | |
| survey of fleet | Jul-00 | Dec-00 |
| final selection | Nov-00 | Dec-00 |
| preparation work | | |
| engine application testing | Jan-01 | Aug-01 |
| vehicle engineering | Jan-01 | Aug-01 |
| component fabrication | Jan-01 | Dec-01 |
| durability verification | | |
| DOC and brackets | Mar-01 | Jun-01 |
| DPF and brackets | Jul-01 | Dec-01 |
| installation of aftertreatment | | |
| trucks with DOC (150) | Jul-01 | Dec-01 |
| trucks with DPF (30) | Jan-02 | Apr-02 |
| trucks with SCR+DPF (5) | May-02 | Aug-02 |
| testing | | |
| backpressure checks (20-40) | Jul-01 | Feb-04 |
| DOC emissions test 1 (2) | Jan-03 | Feb-03 |
| DPF emissions test 1 (2) | Jan-03 | Feb-03 |
| DOC emissions test 2 (2) | Jan-04 | Feb-04 |
| DPF emissions test 2 (2) | Jan-04 | Feb-04 |
| SCR+DPF in-use tests (2) | May-02 | Feb-04 |
| reports | | |
| report 1 (prepare and deliver) | Jan-02 | Apr-02 |
| report 2 (prepare and deliver) | Jan-03 | Apr-03 |
| final report (prepare and deliver) | Jan-04 | Apr-04 |

### FINAL PM PROJECT SCHEDULE

| task | start | end |
|---|---|---|
| project planning | Jul-00 | Oct-00 |
| truck and engine selection | | |
| survey of fleet | Jul-00 | Jun-01 |
| final selection | May-01 | Jun-01 |
| preparation work | | |
| engine application testing | Jan-01 | Aug-01 |
| vehicle engineering | Jan-01 | Dec-01 |
| component fabrication | Jan-01 | Dec-04 |
| durability verification | | |
| DOC and brackets | Nov-01 | Dec-01 |
| DPF and brackets | Jan-02 | Feb-02 |
| installation of aftertreatment | | |
| trucks with DOC (150) | Aug-01 | Apr-03 |
| trucks with DPF (30) | Oct-02 | Mar-05 |
| trucks with SCR+DPF (5) | Jun-03 | Jan-04 |
| testing | | |
| DOC emissions at Mack | Jul-01 | Jul-01 |
| DPF emissions at SwRI | Jul-01 | Aug-01 |
| backpressure monitoring (35) | Oct-02 | Jun-05 |
| WVU dyno 1 (DPF as-new) | May-03 | Jun-03 |
| WVU dyno 2 (DPF after 12-mo) | May-04 | Jun-04 |
| reports | | |
| NESCAUM mid-project | Oct-02 | Oct-02 |
| WVU emissions #1 | Mar-04 | Mar-04 |
| WVU emissions #2 | Mar-05 | Mar-05 |
| NESCAUM final | Jun-05 | Jun-05 |

## 5. West Virginia University Testing

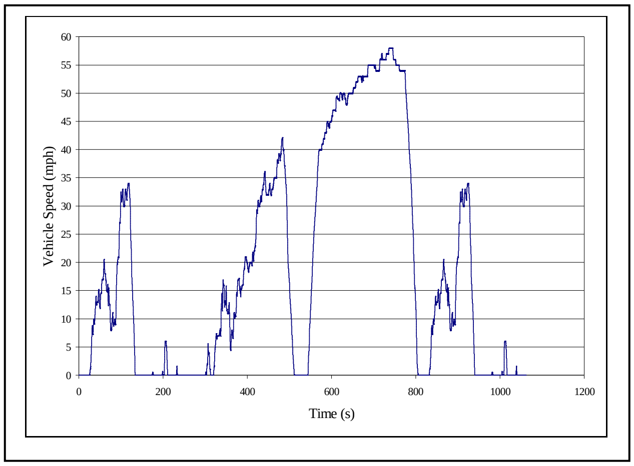
As part of the provisions of the Consent Decree Settlement, two rounds of testing were performed at WVU to assess the long-term operational characteristics of the SCR and the DPF.

A first round of chassis dynamometer testing, using the WVU Transportable Heavy-Duty Vehicle Emission Testing Laboratory ("Translab"), was completed on two of the UPS trucks and one of the DSNY trucks in June of 2003, while a second round of testing on the same vehicles was completed in June of 2004. One UPS truck and the DSNY truck were equipped with SCR and DPF, while the second UPS truck utilized SCR alone. In all, the SCR systems have compiled approximately two million cumulative miles, of which the three tested trucks have over 500,000 miles.

The two UPS trucks were operated over the Heavy-Duty Urban Dynamometer Driving Schedule (UDDS), while the DSNY truck was operated over the William H. Martin Garbage Truck Cycle (WHM), which is more appropriate for the urban-biased duty cycles typical of these vehicles. Research grade analyzers, drawing samples of dilute exhaust from a full-scale constant volume sampling (CVS) tunnel, measured and recorded all criteria emissions. Ammonia emissions were measured and recorded using two methods (the second added for Round 2 testing) to characterize ammonia concentration in the exhaust which may occur in the event of excess urea injection. The table and figures below, describe the emissions sampling equipment and test cycles used for the tests:

| Emissions Constituent | Instrumentation | Collection Type |
|---|---|---|
| NO, NOx | Chemiluminescent Detector (CLD) | Continuous |
| PM | Gravimetric | 70 mm Pallflex Filters |
| HC | Heated Flame Ionization Detector (HFID) | Continuous |
| CO | Non-Dispersive Infrared Detection (NDIR) | Continuous |
| $CO_2$ | Non-Dispersive Infrared Detection (NDIR) | Continuous |
| $NH_3$ | Innova 1302 Photoacoustic | Bag Batch |
| | Eco Physics 822 CM (Round 2 only) | Continuous |

Table 6: Emissions Sampling Equipment, WVU Testing



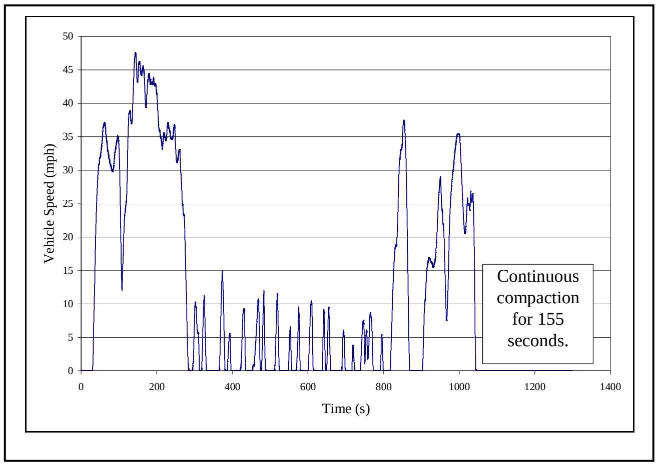




Figure 6: UDDS Test Cycle (UPS Class 8 Trucks)     Figure 7: WHM tests cycle (for DSNY Refuse Truck)

The chassis-based testing program documented emission reduction performance from a fleet of vehicles accumulating mileage on both SCR and DPF control technologies. Comprehensive testing over two years' of vehicle use provided insight into the long-term operational feasibility of these devices. With nearly ½ million miles over the three vehicles tested, it was concluded that:

1. The key goals in the WVU testing portion of the program, was an assessment of SCR NOx-reducing performance over protracted long-term, in-use operation. As the accompanying figure shows, SCR achieved high NOx reduction after one year in-use (79%-95%) and after two years in-use (81%-91%) operation, for all three tested vehicles:

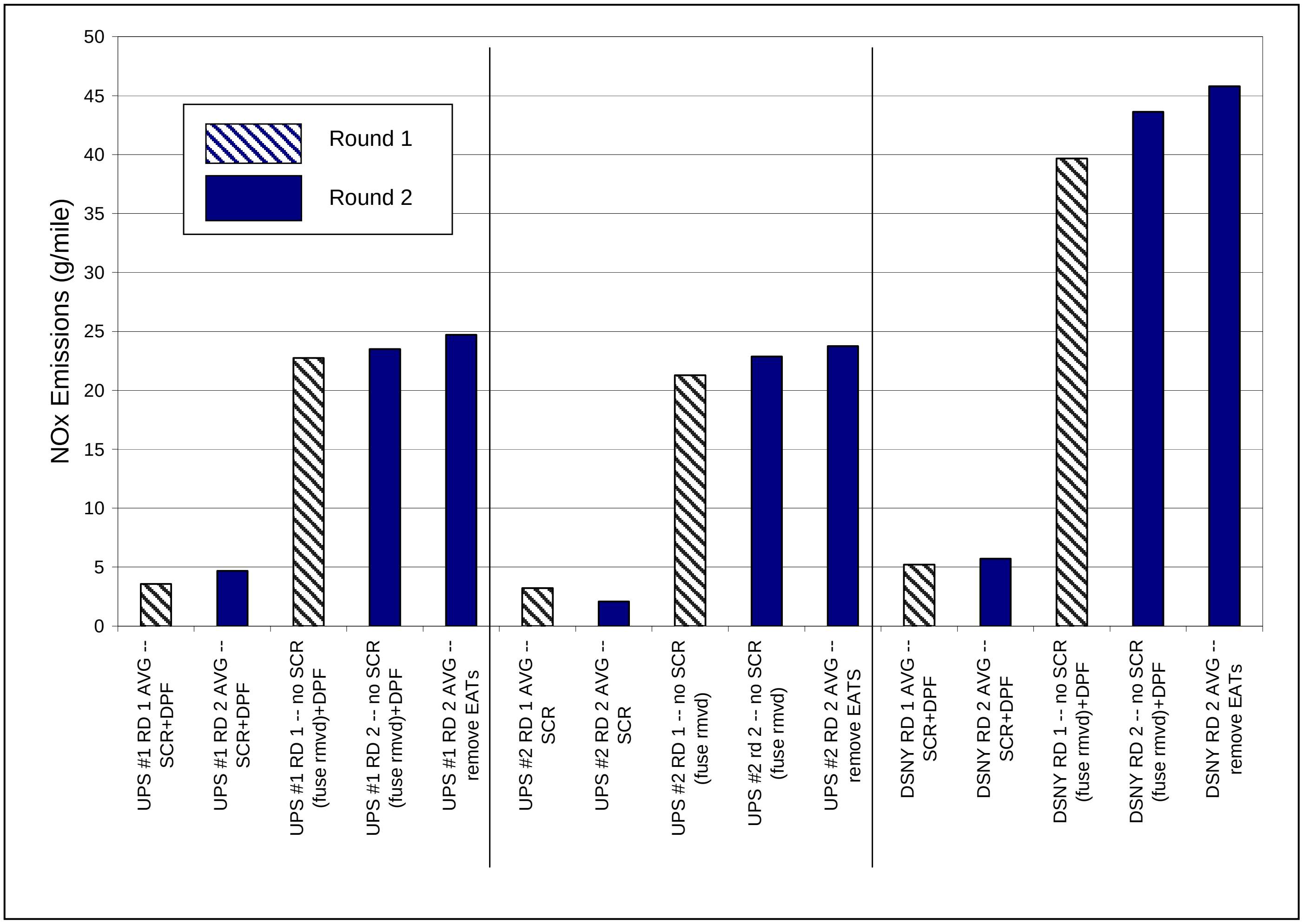



Figure 8: Round 1 and Round 2 NOx Emissions Using SCR

Other noteworthy conclusions from the testing include:

2. SCR NOx-reduction performance was unaffected by the fuel sulfur concentration used (LSD or ULSD). This may provide an opportunity for use of SCR as a viable NOx-reduction device, in regions of the world such as in developing nations, where diesel fuel sulfur content is usually high.

3. HC and CO reductions were, for the most part, in agreement with expectations based on differences in DPF coatings and fuel sulfur levels. Results indicate little to no deterioration in HC and CO reduction performance during the two-year period.

4. PM results were well below the reduction values exhibited in the SwRI dynamometer testing, or in the literature, averaging around 35 – 40%, rather than the 80 – 90% expected. . There are many potential explanations including installation of non-degreened DPFs, possible sulfate-make, and possible system deterioration. In hindsight, improved test planning and post-test PM analysis should be conducted in future studies of this nature.

5. $NH_3$ emissions were minimal after one year in-use and after two years in-use. Low levels of $NH_3$ indicate that the urea injection strategy was performed properly. Overall, integrated results were in agreement with expectations.

6. Combined DPF and SCR systems showed no impact of the DPF on SCR performance. NOx reduction was unaffected with and without DPF. Due to unexpected PM results, the combined system performance upon PM cannot be concluded.

## 6. Appendices

a) **Appendix A, Table of DOC Installations, Waste Management Fleets**

b) **Appendix B, Table of DOC Installations, DSNY Fleet**

c) **Appendix C, Table of DPF Installations, DSNY and UPS Fleets**

d) **Appendix D, Table of SCR+DPF Installations, DSNY Fleet**

e) **Appendix E, Table of SCR Installations, DSNY & UPS Fleets**

f) **Appendix F, Letter to EPA from Mack Trucks entitled "United States v Mack Trucks, Inc., Offset Project Modification," dated December 21, 2004**

# Appendix A, Table of DOC Installations, Waste Management Fleets

## MACK RETROFIT PROGRAM

## Waste Management DOC Installations = 110 Gross, 81 Net

| |
|---|
| blue denotes documented installation, but truck "unavailable" -- added to total |
| yellow denotes indeterminant installation -- not added to total |
| green indicates truck is, or will be, retired -- not added to total |

| | | | | | | | Information At Date of DOC Installation | | | | | Information At Date of Final Check | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tot No. | Loc Nos. | Location | VIN or Unit Number | WM Truck ID | Truck Type | Installer | Date | Mileage | Hours | Notes | y/n | Date | By Whom | Veh Mileage | Veh Hours |
| 1 | 1 | Cranston, RI | 1M2K195C___016424 | 305471 | MR | | 9/16/02 | 16,424 | | replaced 1M2K195CX1M018394 --- Out of Service | N/A | N/A | N/A | N/A | N/A |
| 2 | 2 | Cranston, RI | 1M2K195C___016425 | 305472 | MR | Ballard in Warwick | 9/16/02 | 33,544 | | replaced 1M2K195C11M018395 (306960) | Y | 10/30/2003 | TJD | 47,960 | 8,729 |
| 3 | 3 | Cranston, RI | 1M2K195CX1M018573 | 307041 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 34,632 | | | Y | 10/30/2003 | TJD | 56,014 | 7,355 |
| 4 | 4 | Cranston, RI | 1M2K195C11M018574 | 307042 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 34,969 | | | Y | 10/30/2003 | TJD | 56,625 | 7,320 |
| 5 | 5 | Cranston, RI | 1M2K195C31M018575 | 307044 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 31,227 | | | Y | 10/30/2003 | TJD | 50,984 | 6,806 |
| 6 | 6 | Cranston, RI | 1M2K195C51M018576 | 307045 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 34,073 | | | Y | 10/30/2003 | TJD | 53,179 | 7,179 |
| 7 | 7 | Cranston, RI | 1M2K195C71M018577 | 307046 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 39,867 | Not equipped with a DOC | | N | 10/30/2003 | TJD | 38,638 | 6,287 |
| 8 | 8 | Cranston, RI | 1M2K195C91M018578 | 307047 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 33,553 | | | Y | 10/30/2003 | TJD | 54,539 | 7,000 |
| 9 | 9 | Cranston, RI | 1M2K195C01M018579 | 307048 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 30,953 | | | Y | 10/30/2003 | TJD | 51,460 | 6,853 |
| 10 | 10 | Cranston, RI | 1M2K195C01M018677 | 307049 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 35,007 | | | Y | 10/30/2003 | TJD | 56,995 | 7,259 |
| 11 | 11 | Cranston, RI | 1M2K195C21M018678 | 307050 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 33,780 | | | Y | 10/30/2003 | TJD | 55,821 | 7,557 |
| 12 | 12 | Cranston, RI | 1M2K195C41M018679 | 307051 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 33,516 | | | Y | 10/30/2003 | TJD | 55,334 | 7,301 |
| 13 | 13 | Cranston, RI | 1M2K195C5XM012673 | 202434 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 102,593 | | | Y | 10/30/2003 | TJD | 193 | 1,808 |
| 14 | 14 | Cranston, RI | 1M2K191C0PM004289 | 201685 | MR - Type 2 | Ballard in Warwick | 9/16/02 | 179,422 | | Not on Site | N/A | N/A | N/A | N/A | N/A |
| 15 | 15 | Cranston, RI | 1M2K195C42M019848 | 206018 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 60,851 | | | Y | 10/30/2003 | TJD | 128,405 | 6,507 |
| 16 | 16 | Cranston, RI | 1M2K191C3PM004299 | 201686 | MR - Type 2 | Ballard in Warwick | 9/16/02 | 209,869 | | | Y | 10/30/2003 | TJD | 2,759 | 7,543 |
| 17 | 17 | Cranston, RI | 1M2K195C0WM010733 | 201698 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 129,470 | | | Y | 10/30/2003 | TJD | 164,314 | 14,209 |
| 18 | 18 | Cranston, RI | 1M2K195C2WM011561 | 201697 | MR - Type 1 | Ballard in Warwick | 9/16/02 | 142,372 | | | Y | 10/30/2003 | TJD | 187,269 | 13,661 |
| 19 | 19 | Cranston, RI | 1M2K195C___004845 | 201688 | MR | Ballard in Warwick | 9/16/02 | 29,281 | | replaced 1M2K191C7PM004290 | Y | 10/30/2003 | TJD | 298,991 | 32 |
| 20 | 20 | Cranston, RI | | | LE - Type 3 | Cranston | 11/6/01 | 33,544 | | Could not find - no truck # or VIN to check against | N/A | N/A | N/A | N/A | N/A |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | 1 | Londonderry, NH | 1M2K181C9RM005647 | 201434 | MR - Type 2 | Londonderry | 7/30/02 | 250,067 | 7,082 | | Y | 10/21/2003 | TJD | 8,305 | 680 |
| 22 | 2 | Londonderry, NH | 1M2K181C0RM005648 | 201441 | MR - Type 2 | Londonderry | 6/28/02 | 221,605 | 8,166 | Gone from site. | N | 10/21/2003 | TJD | | |
| 23 | 3 | Londonderry, NH | 1M2K195C0YM015773 | 204492 | MR - Type 1 | Londonderry | 7/24/02 | 106,333 | 6,616 | | Y | 10/21/2003 | TJD | 154,753 | 10,076 |
| 24 | 4 | Londonderry, NH | 1M2K195C2XM015644 | 203608 | MR - Type 1 | Londonderry | 7/9/02 | 101,252 | 8,425 | | Y | 10/21/2003 | TJD | 152,525 | 11,986 |
| 25 | 5 | Londonderry, NH | 1M2K195C7YM015771 | 204490 | MR - Type 1 | | | has part#2ME31Q2BO (11/21/02 mile/hr 82699.9/7009.2 | | | Y | | | | |
| 26 | 6 | Londonderry, NH | 1M2K195C9XM015026 | 203584 | MR - Type 1 | Londonderry | 6/24/02 | 132,616 | 8,375 | | Y | 10/21/2003 | TJD | 172,727 | 11,323 |
| 27 | 7 | Londonderry, NH | 1M2K195C9YM015772 | 204491 | MR - Type 1 | Londonderry | 7/3/02 | 91,742 | 6,165 | | Y | 10/21/2003 | TJD | 178 | 9,700 |
| 28 | 8 | Londonderry, NH | 1M2K195C0WM012191 | 206704 | MR - Type 1 | Londonderry | 6/25/02 | 200,324 | 2,112 | | Y | 10/21/2003 | TJD | 256,236 | 5,493 |
| 29 | 9 | Londonderry, NH | 1M2K195C3LM019449 | 307338 | MR - Type 1 | Londonderry | 7/4/02 | 22,635 | 2,782 | replaced 1M2K166C5LM002149 | Y | 10/21/2003 | TJD | 47,797 | 6,648 |
| 30 | 10 | Londonderry, NH | 1M2K195C1XM014503 | 306835 | MR - Type 1 | Londonderry | 6/28/02 | 79,087 | 8,954 | | Y | 10/21/2003 | TJD | 106,331 | 1,828 |
| 31 | 11 | Londonderry, NH | 1M2K195C2XM012713 | 302006 | MR - Type 1 | Londonderry | 6/21/02 | 92,522 | 9,643 | | Y | 10/21/2003 | TJD | 122,516 | 3,161 |
| 32 | 12 | Londonderry, NH | 1M2K195C4XM012714 | 302008 | MR - Type 1 | Londonderry | 7/4/02 | 97,613 | 85 | | Y | 10/21/2003 | TJD | 131,902 | 3,629 |
| 33 | 13 | Londonderry, NH | 1M2K195C6XM014500 | 306386 | MR - Type 1 | Londonderry | 6/20/02 | 69,151 | 8,590 | | Y | 10/21/2003 | TJD | 108,090 | 2,440 |
| 34 | 14 | Londonderry, NH | 1M2K195C7XM014506 | 306834 | MR - Type 1 | Londonderry | 6/27/02 | 71,118 | 8,442 | | Y | 10/21/2003 | TJD | 103,687 | 1,715 |
| 35 | 15 | Londonderry, NH | 1M2K195C8XM012716 | 302007 | MR - Type 1 | Londonderry | 6/24/02 | 117,696 | 9,861 | | Y | 10/21/2003 | TJD | 158,858 | 3,555 |
| 36 | 16 | Londonderry, NH | 1M2K195C8XM014501 | 306832 | MR - Type 1 | Londonderry | 7/2/02 | 90,989 | 9,220 | | Y | 10/21/2003 | TJD | 126,424 | 2,650 |
| 37 | 17 | Londonderry, NH | 1M2K195CXXM014502 | 306833 | MR - Type 1 | Londonderry | 6/20/02 | 100,392 | 8,903 | | Y | 10/21/2003 | TJD | 144,031 | 2,334 |
| 38 | 18 | Londonderry, NH | 1M2AC07C8YM004079 | 520023 | LE - Type 3 | Londonderry | 11/7/01 | | 2,786 | Not on site at time of inspection | | | | | |
| 39 | 19 | Londonderry, NH | 1M2K195CXWM012540 | | MR - Type 1 | ------------ | ------------ | ------------ | ------------ | to be retired | | | | | |
| 40 | 20 | Londonderry, NH | 1M2K166C5LM002149 | | MR - Type 2 | ------------ | ------------ | ------------ | ------------ | to be retired | | | | | |
| 41 | 21 | Londonderry, NH | 1M2K166C8KM001933 | | MR - Type 2 | ------------ | ------------ | ------------ | ------------ | to be retired | | | | | |
| 42 | 22 | Londonderry, NH | 1M2K166C9KM001567 | | MR - Type 2 | | | not on equipment list @ facility, probably retired (11/21/02) | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 1 | Portland, ME | 1M2AC07C4SM001302 | 260096 | LE - Type 3 | | 9/11/02 | 153,000 | | Out of Service | N/A | 10/29/2003 | TJD | N/A |
| 44 | 2 | Portland, ME | 1M2K138C1LM003200 | 201773 | MR - Type 2 | | 9/11/02 | 153,000 | | Not on site. | N/A | 10/29/2003 | TJD | N/A |
| 45 | 3 | Portland, ME | 1M2K138C5KM002873 | 201771 | MR - Type 2 | | 9/11/02 | 389,000 | | | Y | 10/29/2003 | TJD | 411,115 |
| 46 | 4 | Portland, ME | 1M2K138C9LM003199 | 201772 | MR - Type 2 | | 9/11/02 | 76,000 | | | Y | 10/29/2003 | TJD | 8,278 |
| 47 | 5 | Portland, ME | 1M2K195C1XM013240 | 201780 | MR - Type 1 | | 9/11/02 | 105,000 | | | Y | 10/29/2003 | TJD | 139,483 |
| 48 | 6 | Portland, ME | 1M2K195C7VM010095 | 201774 | MR - Type 1 | | | | | Not on Site | N/A | 10/29/2003 | TJD | N/A |
| 49 | 7 | Portland, ME | 1M2K195C8XM014188 | 200556 | MR - Type 1 | | 9/11/02 | 88,000 | | | Y | 10/29/2003 | TJD | 117,892 |
| 50 | 8 | Portland, ME | 1M2K195CXWM011811 | 201777 | MR - Type 1 | | 9/11/02 | 131,000 | | | Y | 10/29/2003 | TJD | 159,475 |
| 51 | 9 | Portland, ME | 1M2K195CXXM014189 | 200557 | MR - Type 1 | | 9/11/02 | 120,000 | | | Y | 10/29/2003 | TJD | 169,402 |
| 52 | 10 | Portland, ME | 1M2K195C2YM016617 | 305232 | MR - Type 1 | | | | | Not equipped with a DOC | N | 10/29/2003 | TJD | 77,835 |
| 53 | 11 | Portland, ME | 1M2K195C5SM006056 | 302531 | MR - Type 2 | | 9/11/02 | 138,000 | | | Y | 10/29/2003 | TJD | 164,391 |
| 54 | 12 | Portland, ME | 1M2K195CXRM004961 | 302532 | MR - Type 2 | | 9/11/02 | 93,000 | | | Y | 10/29/2003 | TJD | 115,201 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | 1 | Rochester, NH | 1M2A07C8WM002457 | 260072 | LE - Type 3 | Rochester | done | | | | Y | 10/29/2003 | TJD | 145,389 | 4,129 |
| 56 | 2 | Rochester, NH | 1M2AC07C4WM002536 | 260073 | LE - Type 3 | Rochester | done | | | | Y | 10/29/2003 | TJD | 121,267 | 3,378 |
| 57 | 3 | Rochester, NH | 1M2AC07C6WM002537 | 260074 | LE - Type 3 | Rochester | done | | | | Y | 10/29/2003 | TJD | 99,440 | 2,054 |
| 58 | 4 | Rochester, NH | 1M2AC07C4WM002570 | 505026 | LE - Type 3 | Rochester | done | | | | Y | 10/29/2003 | TJD | 142,539 | 4,431 |
| 59 | 5 | Rochester, NH | 1M2AC07CXWM002573 | Could not find | LE - Type 3 | Rochester | done | | | Could not find truck | N/A | 10/29/2003 | TJD | N/A | N/A |
| 60 | 6 | Rochester, NH | 1M2AC07CYM005040 | Could not find | LE - Type 3 | Rochester | done | | | Could not find truck | N/A | 10/29/2003 | TJD | N/A | N/A |
| 61 | 7 | Rochester, NH | 1M2K185C6XM007430 | 200090 | MR - Type 1 | Rochester | done | | | | Y | 10/29/2003 | TJD | 194,455 | 5,012 |
| 62 | 8 | Rochester, NH | 1M2K191C7NM003640 | Could not find | MR - Type 2 | Rochester | done | | | Could not find truck | N/A | 10/29/2003 | TJD | N/A | N/A |
| 63 | 9 | Rochester, NH | 1M2K191C7PM004595 | 200113 | MR - Type 2 | Rochester | done | | | | Y | 10/29/2003 | TJD | 381,156 | 7,229 |
| 64 | 10 | Rochester, NH | 1M2K195C4XM015208 | 200824 | MR - Type 1 | Rochester | done | | | | Y | 10/29/2003 | TJD | 161,034 | 12,241 |
| 65 | 11 | Rochester, NH | 1M2K195C6XM015209 | 200825 | MR - Type 1 | Rochester | done | | | | Y | 10/29/2003 | TJD | 182,113 | 11,354 |
| 66 | 12 | Rochester, NH | 1M2K185C8XM007431 | 200025 | MR - Type 1 | Rochester | done | | | | Y | 10/29/2003 | TJD | 290,936 | 4,705 |
| 67 | 13 | Rochester, NH | 1M2K166C7DM002198 | Could not find | MR - Type 1 | Rochester | done | | | Could not find truck | N/A | 10/29/2003 | TJD | N/A | N/A |
| 68 | 14 | Rochester, NH | 1M2K195C91M018841 | 205814 | MR - Type 1 | Rochester | done | | | | Y | 10/29/2003 | TJD | 112,402 | 2,531 |
| 69 | 15 | Rochester, NH | 1M2K195C01M018842 | 205815 | MR - Type 1 | Rochester | done | | Not equipped with a DOC | | N | 10/29/2003 | TJD | 111,224 | 6,793 |
| 70 | 16 | Rochester, NH | 1M2K195C71M017946 | 206048 | MR - Type 1 | Rochester | done | | | | Y | 10/29/2003 | TJD | 105,300 | 6,738 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 71 | 1 | Sommerville, MA | 1M2K195C6VM010265 | 302065 | MR - Type 1 | McDevitt in Avon | 9/20/02 | 41,908 | | | Y | 10/27/2003 | TJD | 51,409 | 5,541 |
| 72 | 2 | Sommerville, MA | 1M2K195C8VM010266 | 302066 | MR - Type 1 | McDevitt in Avon | 9/27/02 | 38,922 | | | Y | 10/27/2003 | TJD | 48,226 | 4,688 |
| 73 | 3 | Sommerville, MA | 1M2K195C5YM015770 | 306485 | MR - Type 1 | McDevitt in Avon | 11/21/02 | 50,125 | | Not on site. | N/A | 10/27/2003 | TJD | N/A | N/A |
| 74 | 4 | Sommerville, MA | 1M2K195CXYM015778 | 306486 | MR - Type 1 | McDevitt in Avon | 8/27/02 | 29,560 | | Not on site. | N/A | 10/27/2003 | TJD | N/A | N/A |
| 75 | 5 | Sommerville, MA | 1M2K195C0WM012207 | 302087 | MR - Type 1 | McDevitt in Avon | 8/27/02 | 57,358 | | | Y | 10/27/2003 | TJD | 67,469 | 3,435 |
| 76 | 6 | Sommerville, MA | 1M2K195C2WM012208 | 302088 | MR - Type 1 | McDevitt in Avon | 8/20/02 | 36,510 | | Not on site. | N/A | 10/27/2003 | TJD | N/A | N/A |
| 77 | 7 | Sommerville, MA | 1M2K195C4WM012209 | 302089 | MR - Type 1 | McDevitt in Avon | | | | | Y | 10/27/2003 | TJD | 58,208 | 2,917 |
| 78 | 8 | Sommerville, MA | 1M2K195C0XM015030 | 304575 | MR - Type 1 | McDevitt in Avon | 8/5/02 | 47,061 | | | Y | 10/27/2003 | TJD | 30,099 | 9,397 |
| 79 | 9 | Sommerville, MA | 1M2K195C2XM015031 | 304571 | MR - Type 1 | McDevitt in Avon | 8/12/02 | 20,000 | | Not on site. | N/A | 10/27/2003 | TJD | N/A | N/A |
| 80 | 10 | Sommerville, MA | 1M2K195C9XM013311 | 302091 | MR - Type 1 | McDevitt in Avon | 9/25/02 | 26,941 | | | Y | 10/27/2003 | TJD | 32,235 | 939 |
| 81 | 11 | Sommerville, MA | 1M2K195C0XM013312 | 302092 | MR - Type 1 | McDevitt in Avon | | | | | Y | 10/27/2003 | TJD | 35,422 | 9,882 |
| 82 | 12 | Sommerville, MA | 1M2K195CXXM012670 | 305770 | MR - Type 1 | McDevitt in Avon | 8/19/02 | 21,000 | | | Y | 10/27/2003 | TJD | 37,893 | 9,815 |
| 83 | 13 | Sommerville, MA | 1M2K195C1YM016625 | 305230 | MR - Type 1 | McDevitt in Avon | 9/20/02 | 28,918 | | | Y | 10/27/2003 | TJD | 39,000 | 9,389 |
| 84 | 14 | Sommerville, MA | 1M2K195C3YM016626 | 305231 | MR - Type 1 | McDevitt in Avon | | | | | Y | 10/27/2003 | TJD | 38,371 | 9,187 |
| 85 | 15 | Sommerville, MA | 1M2K195C3VM010582 | | MR - | McDevitt in Avon | 9/26/02 | 40,398 | | Could not find truck | N/A | 10/27/2003 | TJD | N/A | N/A |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 86 | 1 | Woburn, MA | 1M2K195C1XM013237 | 200554 | MR - Type 1 | | 8/1/01 | | | | Y | 10/22/2003 | TJD | 124,978 | 1,622 |
| 87 | 2 | Woburn, MA | 1M2K195C3RM004977 | 201475 | MR - Type 2 | | 10/24/02 | | | Not equipped with a DOC | N | 10/22/2003 | TJD | 254,304 | 5,598 |
| 88 | 3 | Woburn, MA | 1M2K195C3RM004980 | 201476 | MR - Type 2 | | | | | Not on site. | N/A | 10/22/2003 | TJD | N/A | N/A |
| 89 | 4 | Woburn, MA | 1M2K195C0VM010097 | 201479 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 219,187 | 5,828 |
| 90 | 5 | Woburn, MA | 1M2K195C9WM010441 | 201488 | MR - Type 1 | | 10/24/02 | | | Truck out of service - Burned by fire. | N/A | 10/22/2003 | TJD | N/A | N/A |
| 91 | 6 | Woburn, MA | 1M2K195C3XM012610 | 201489 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 169,357 | 4,640 |
| 92 | 7 | Woburn, MA | 1M2K195C5WM012560 | 302128 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 137,797 | 4,551 |
| 93 | 8 | Woburn, MA | 1M2K195C7WM012561 | 302129 | MR - Type 1 | | | | | | Y | 10/22/2003 | TJD | 130,248 | 4,341 |
| 94 | 9 | Woburn, MA | 1M2K195C0XM012905 | 302131 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 96,154 | 5,647 |
| 95 | 10 | Woburn, MA | 1M2K195C9XM012904 | 302133 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 82,069 | 5,168 |
| 96 | 11 | Woburn, MA | 1M2K195C7YM016886 | 305456 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 74,649 | 10,520 |
| 97 | 12 | Woburn, MA | 1M2K195C9YM016887 | 305457 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 39,327 | 9,359 |
| 98 | 13 | Woburn, MA | 1M2K195C3XM012672 | 305748 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 42,506 | 9,855 |
| 99 | 14 | Woburn, MA | 1M2K195C31M018057 | 306487 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 75,697 | 8,135 |
| 100 | 15 | Woburn, MA | 1M2K195C51M017797 | 306488 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 72,918 | 7,890 |
| 101 | 16 | Woburn, MA | 1M2K195C11M017795 | 306489 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 73,421 | 8,180 |
| 102 | 17 | Woburn, MA | 1M2K195C31M017796 | 306490 | MR - Type 1 | | 10/24/02 | | | At Mack dealer. | N/A | 10/22/2003 | TJD | | |
| 103 | 18 | Woburn, MA | 1M2K195C51M018058 | 306622 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 54,845 | 7,925 |
| 104 | 19 | Woburn, MA | 1M2K195C71M017798 | 306623 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 58,800 | 8,210 |
| 105 | 20 | Woburn, MA | 1M2K195C01M019084 | 307255 | MR - Type 1 | | 10/24/02 | | | | Y | 10/22/2003 | TJD | 49,905 | 7,149 |
| 106 | 21 | Woburn, MA | 1M2AC07C9TM001278 | 260798 | LE - Type 3 | | 8/1/01 | | | | Y | 10/22/2003 | TJD | 137,499 | 7,500 |
| 107 | 22 | Woburn, MA | 1M2AC07C9TM001281 | 260799 | LE - Type 3 | | | | | | Y | 10/22/2003 | TJD | 188,155 | 9,689 |
| 108 | 23 | Woburn, MA | 1M2AC07C25M001184 | 260800 | LE - Type 3 | | | | | | Y | 10/22/2003 | TJD | 217,596 | 2,774 |
| 109 | 24 | Woburn, MA | 1M2AC07C5WM002450 | 260801 | LE - Type 3 | | | | | Not equipped with a DOC | N | 10/22/2003 | TJD | 117,423 | 1,428 |

# Appendix B, Table of DOC Installations, Department of Sanitation New York Fleet

## MACK RETROFIT PROGRAM
## DSNY DOC Installations = 55 Units

| No. | Vehicle ID No. | Depot Location | VIN | Installation Date | Installation Dealer | Vehicle Miles at Time of Installation | Vehicle Hours at Time of Installation | ECT Manufacturer | Emissions Technology |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 25CN -029 | MW07 | 1M2AC07C3YM003437 | March 6, 2003 | Queens Gabrielli | 16,854 | 2,703 | Donaldosn | DOC |
| 2 | 25CN -060 | QE08 | 1M2AC07C3YM003468 | February 20, 2003 | Queens Gabrielli | 55,256 | 5,207 | Donaldosn | DOC |
| 3 | 25CN -091 | QE08 | 1M2AC07C3YM003499 | March 11, 2003 | Queens Gabrielli | 52,243 | 1,965 | Donaldosn | DOC |
| 4 | 25CN -100 | QE12 | 1M2AC07C0YM003508 | February 20, 2003 | Queens Gabrielli | 31,776 | 4,839 | Donaldosn | DOC |
| 5 | 25CN -103 | QE08 | 1M2AC07C0YM003511 | March 26, 2003 | Queens Gabrielli | 54,261 | 5,300 | Donaldosn | DOC |
| 6 | 25CN -146 | QE12 | 1M2AC07C7YM003554 | March 31, 2003 | Queens Gabrielli | 56,520 | 5,400 | Donaldosn | DOC |
| 7 | 25CN -168 | QE10 | 1M2AC07C6YM003576 | February 20, 2003 | Queens Gabrielli | 54,533 | 4,662 | Donaldosn | DOC |
| 8 | 25CN -207 | QE10 | 1M2AC07C1YM003615 | April 1, 2003 | Queens Gabrielli | 48,299 | 4,304 | Donaldosn | DOC |
| 9 | 25CN -219 | QE13 | 1M2AC07C8YM003627 | February 26, 2003 | Queens Gabrielli | 30,301 | 3,526 | Donaldosn | DOC |
| 10 | 25CN -220 | QE11 | 1M2AC07CXYM003628 | March 6, 2003 | Queens Gabrielli | 45,015 | 4,511 | Donaldosn | DOC |
| 11 | 25CN -291 | QE13 | 1M2AC07C0YM003699 | February 24, 2003 | Queens Gabrielli | 38,526 | 4,140 | Donaldosn | DOC |
| 12 | 25CN -310 | BXW04 | 1M2AC07C0YM003718 | April 10, 2002 | Bronx Gabrielli | 7,306 | 1,456 | Donaldosn | DOC |
| 13 | 25CN -327 | BXW02 | 1M2AC07C0YM003735 | December 6, 2001 | Bronx Gabrielli | 5,331 | 1,179 | Donaldosn | DOC |
| 14 | 25CN -349 | QE13 | 1M2AC07CXYM003757 | February 21, 2003 | Queens Gabrielli | 41,827 | 4,515 | Donaldosn | DOC |
| 15 | 25CN -361 | BXW03 | 1M2AC07C6YM003769 | December 4, 2001 | Bronx Gabrielli | 5,096 | 1,011 | Donaldosn | DOC |
| 16 | 25CN -374 | BXW02 | 1M2AC07C9YM003782 | December 4, 2001 | Bronx Gabrielli | 5,370 | 1,273 | Donaldosn | DOC |
| 17 | 25CN -425 | BXW01 | 1M2AC07C31M003833 | December 4, 2001 | Bronx Gabrielli | 6,948 | 1,699 | Donaldosn | DOC |
| 18 | 25CN -558 | QE11 | 1M2AC07C01M003966 | March 6, 2003 | Queens Gabrielli | 30,375 | 2,820 | Donaldosn | DOC |
| 19 | 25CN -581 | BXW04 | 1M2AC07C11M003989 | April 12, 2002 | Bronx Gabrielli | 4,311 | 806 | Donaldosn | DOC |
| 20 | 25CN -588 | QE11 | 1M2AC07C91M003996 | March 5, 2003 | Queens Gabrielli | 31,717 | 2,673 | Donaldosn | DOC |
| 21 | 25CN -595 | BXW02 | 1M2AC07C01M004003 | December 6, 2001 | Bronx Gabrielli | 2,334 | 501 | Donaldosn | DOC |
| 22 | 25CN -609 | BXW03 | 1M2AC07C71M004239 | December 5, 2001 | Bronx Gabrielli | 2,602 | 418 | Donaldosn | DOC |
| 23 | 25CN -612 | QE12 | 1M2AC07C71M004242 | March 7, 2003 | Queens Gabrielli | 46,582 | 3,506 | Donaldosn | DOC |
| 24 | 25CN -622 | BXW04 | 1M2AC07C22M005722 | April 22, 2002 | Bronx Gabrielli | 4,170 | 697 | Donaldosn | DOC |
| 25 | 25CN -638 | QE08 | 1M2AC07C31M004268 | February 20, 2003 | Queens Gabrielli | 36,411 | 2,862 | Donaldosn | DOC |
| 26 | 25CN -654 | BXW01 | 1M2AC07C11M004320 | December 5, 2001 | Bronx Gabrielli | 2,084 | 519 | Donaldosn | DOC |
| 27 | 25CN -655 | QE08 | 1M2AC07C31M004285 | April 1, 2003 | Queens Gabrielli | 41,555 | 3,310 | Donaldosn | DOC |
| 28 | 25CN -657 | BXW03 | 1M2AC07C71M004287 | December 6, 2001 | Bronx Gabrielli | 1,682 | 221 | Donaldosn | DOC |
| 29 | 25CN -658 | QE07 | 1M2AC07C91M004288 | February 21, 2003 | Queens Gabrielli | 23,987 | 2,566 | Donaldosn | DOC |
| 30 | 25CN -659 | BXW03 | 1M2AC07C31M004321 | December 7, 2001 | Bronx Gabrielli | 1,876 | 261 | Donaldosn | DOC |
| 31 | 25CN -663 | BXW04 | 1M2AC07C11M004303 | April 26, 2002 | Bronx Gabrielli | 4,279 | 737 | Donaldosn | DOC |
| 32 | 25CN -668 | BXW02 | 1M2AC07C31M004299 | December 11, 2001 | Bronx Gabrielli | 2,144 | 408 | Donaldosn | DOC |
| 33 | 25CN -669 | BXW03 | 1M2AC07C91M004310 | December 10, 2001 | Bronx Gabrielli | 2,150 | 369 | Donaldosn | DOC |
| 34 | 25CN -670 | BXW01 | 1M2AC07C01M004311 | December 6, 2001 | Bronx Gabrielli | 1,629 | 66 | Donaldosn | DOC |
| 35 | 25CN -672 | QE07 | 1M2AC07C81M004329 | April 1, 2003 | Queens Gabrielli | 24,189 | 2,820 | Donaldosn | DOC |
| 36 | 25CN -680 | BXW04 | 1M2AC07C61M004295 | April 24, 2002 | Bronx Gabrielli | 4,613 | 979 | Donaldosn | DOC |
| 37 | 25CN -689 | BXW02 | 1M2AC07C41M004344 | December 7, 2001 | Bronx Gabrielli | 1,903 | 336 | Donaldosn | DOC |
| 38 | 25CN -703 | BXW01 | 1M2AC07C41M004358 | December 7, 2001 | Bronx Gabrielli | 2,331 | 510 | Donaldosn | DOC |
| 39 | 25CN -707 | BXW01 | 1M2AC07C61M004362 | December 10, 2001 | Bronx Gabrielli | 2,061 | 414 | Donaldosn | DOC |
| 40 | 25CN -717 | BXW03 | 1M2AC07C12M005663 | December 11, 2001 | Bronx Gabrielli | 1,938 | 295 | Donaldosn | DOC |
| 41 | 25CN -719 | BXW02 | 1M2AC07C52M005665 | December 8, 2001 | Bronx Gabrielli | 2,151 | 498 | Donaldosn | DOC |
| 42 | 25CN -720 | BXW04 | 1M2AC07C72M005666 | May 3, 2002 | Bronx Gabrielli | 3,943 | 704 | Donaldosn | DOC |
| 43 | 25CN -725 | BXW01 | 1M2AC07C02M005671 | December 11, 2001 | Bronx Gabrielli | 1,904 | 410 | Donaldosn | DOC |
| 44 | 25CN -726 | BXW02 | 1M2AC07C22M005672 | December 12, 2001 | Bronx Gabrielli | 2,105 | 342 | Donaldosn | DOC |
| 45 | 25CN -727 | BXW01 | 1M2AC074C42M005673 | December 12, 2001 | Bronx Gabrielli | 2,078 | 439 | Donaldosn | DOC |
| 46 | 25CN -728 | BXW02 | 1M2AC07C62M005674 | December 12, 2001 | Bronx Gabrielli | 2,203 | 482 | Donaldosn | DOC |
| 47 | 25CN -732 | BXW04 | 1M2AC07C32M005678 | April 25, 2002 | Bronx Gabrielli | 3,704 | 747 | Donaldosn | DOC |
| 48 | 25CN -735 | BXW04 | 1M2AC07C32M005681 | May 1, 2002 | Bronx Gabrielli | 2,990 | 555 | Donaldosn | DOC |
| 49 | 25CN -738 | BXW04 | 1M2AC07C92M005684 | May 1, 2002 | Bronx Gabrielli | 4,638 | 929 | Donaldosn | DOC |
| 50 | 25CN -739 | BXW04 | 1M2AC07C02M005685 | May 8, 2002 | Bronx Gabrielli | 4,795 | 927 | Donaldosn | DOC |
| 51 | 25CN -745 | BXW01 | 1M2AC07C62M005691 | December 13, 2001 | Bronx Gabrielli | 1,772 | 328 | Donaldosn | DOC |
| 52 | 25CN -746 | BXW02 | 1M2AC07C82M005692 | December 13, 2001 | Bronx Gabrielli | 2,640 | 504 | Donaldosn | DOC |
| 53 | 25CN -754 | BXW03 | 1M2AC07C32M005700 | December 13, 2001 | Bronx Gabrielli | 1,737 | 251 | Donaldosn | DOC |
| 54 | 25CN -762 | BXW04 | 1M2AC07C82M005708 | November 6, 2001 | DSNY CRS | 1,315 | 116 | Donaldosn | DOC |
| 55 | 25CU -221 | QE11 | 1M2AC07C72M005943 | March 5, 2003 | Queens Gabrielli | 14,364 | 1,492 | Donaldosn | DOC |

## MACK RETROFIT PROGRAM
## DSNY DPF Installations = 28 Units

| No. | Vehicle ID No. | Depot Location | VIN | Installation Date | Installation Dealer | Vehicle Miles at Time of Installation | Vehicle Hours at Time of Installation | ECT Manufacturer | Emissions Technology |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 25CU -101 | ME11 | 1M2AC07C82M005823 | July 13, 2004 | CRS | 21,069 | 3,099 | Engelhard DPX | DPF |
| 2 | 25CU -205 | ME11 | 1M2AC07C92M005927 | June 29, 2004 | CRS | 22,925 | 2,853 | Engelhard DPX | DPF |
| 3 | 25CU -211 | ME11 | 1M2AC07C42M005933 | June 15, 2004 | CRS | 22,877 | 2,936 | Engelhard DPX | DPF |
| 4 | 25CW -025 | BXW01 | 1M2AC07C13M007088 | April 11, 2003 | CRS | 3,651 | 872 | Engelhard DPX | DPF |
| 5 | 25CW -114 | BN02 | 1M2AC07C03M007177 | February 14, 2005 | CRS | 15,018 | 3,850 | Engelhard DPX | DPF |
| 6 | 25CW -118 | R03 | 1M2AC07C23M007181 | February 5, 2005 | CRS | 15,575 | 2,121 | Engelhard DPX | DPF |
| 7 | 25CW -150 | ME03 | 1M2AC07C03M007213 | January 25, 2005 | CRS | 21,254 | 2,854 | Engelhard DPX | DPF |
| 8 | 25CW -160 | ME03 | 1M2AC07C33M007223 | January 19, 2005 | CRS | 22,675 | 22 | Engelhard DPX | DPF |
| 9 | 25CW -170 | MW01 | 1M2AC07C63M007233 | January 20, 2005 | CRS | 15,415 | 2,744 | Engelhard DPX | DPF |
| 10 | 25CW -176 | ME11 | 1M2AC07C73M007239 | April 11, 2003 | CRS | 1,226 | 110 | Engelhard DPX | DPF |
| 11 | 25CW -181 | ME11 | 1M2AC07C03M007244 | May 10, 2004 | CRS | 7,812 | 1,106 | Engelhard DPX | DPF |
| 12 | 25CW -184 | BN07 | 1M2AC07C63M007247 | January 11, 2005 | CRS | 8,005 | 2,973 | Engelhard DPX | DPF |
| 13 | 25CW -185 | ME11 | 1M2AC07C83M007248 | May 27, 2004 | CRS | 6,717 | 993 | Engelhard DPX | DPF |
| 14 | 25CW -189 | BN07 | 1M2AC07CX3M007252 | January 13, 2005 | CRS | 10,136 | 3,044 | Engelhard DPX | DPF |
| 15 | 25CW -200 | ME11 | 1M2AC07C43M007263 | June 8, 2004 | CRS | 19,748 | 2,159 | Engelhard DPX | DPF |
| 16 | 25CW -206 | BN07 | 1M2AC07C53M007269 | January 24, 2005 | CRS | 7,735 | 3,240 | Engelhard DPX | DPF |
| 17 | 25CW -529 | MW01 | 1M2AC07C54M009072 | February 2, 2005 | CRS | 7,460 | 1,032 | Engelhard DPX | DPF |
| 18 | 25CW -530 | MW01 | 1M2AC07C74M009073 | February 9, 2005 | CRS | 5,203 | 778 | Engelhard DPX | DPF |
| 19 | 25CW -557 | R01 | 1M2AC07C64M009100 | January 11, 2005 | CRS | 4,036 | 561 | Engelhard DPX | DPF |
| 20 | 25CW -715 | ME11 | 1M2AC07C94M009656 | February 3, 2005 | CRS | 5,429 | 620 | Engelhard DPX | DPF |
| 21 | 25CW -733 | ME11 | 1M2AC07C04M009674 | March 16, 2005 | CRS | 7,759 | 890 | Engelhard DPX | DPF |
| 22 | 25CW -736 | R01 | 1M2AC07C64M009677 | January 11, 2005 | CRS | 4,141 | 513 | Engelhard DPX | DPF |
| 23 | 25CW -738 | MW11 | 1M2AC07CX4M009679 | February 24, 2005 | CRS | 6,219 | 698 | Engelhard DPX | DPF |
| 24 | 25CW -750 | ME11 | 1M2AC07C04M009691 | March 23, 2005 | CRS | 8,102 | 978 | Engelhard DPX | DPF |
| 25 | 25CW -753 | ME11 | 1M2AC07C64M009694 | February 17, 2005 | CRS | 5,651 | 624 | Engelhard DPX | DPF |
| 26 | 25CW -784 | BN02 | 1M2AC07C24M009725 | January 13, 2005 | CRS | 8,024 | 2,977 | Engelhard DPX | DPF |
| 27 | 25CW -792 | BN02 | 1M2AC07C14M009733 | January 21, 2005 | CRS | 1,400 | 175 | Engelhard DPX | DPF |
| 28 | 25CW -800 | BN02 | 1M2AC07C04M009741 | February 9, 2005 | CRS | 19,566 | 309 | Engelhard DPX | DPF |

## UPS DPF Installations = 3 Units
## All DPFs, Engelhard DPX

| No. | Vehicle ID No. | Depot Location | VIN | Installation | | First Failure | | Second failure | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | Miles | Date | Miles | Date | Miles |
| 1 | 265777 | Stratford | 25214 | June-03 | 216,545 | January-04 | 279,000 | May-04 | 324,000 |
| 2 | 265778 | Stratford | 25215 | January-04 | 243,000 | May-04 | 280,000 | not installed | |
| 3 | 265780 | Stratford | 25217 | January-04 | 307,000 | April-04 | 339,000 | not installed | |

## MACK RETROFIT PROGRAM
## DSNY SCR+DPF Installations = 2 Units

| No. | Vehicle ID No. | Depot Location | VIN | Installation Date | Installation Dealer | Vehicle Miles at Time of Installation | Vehicle Hours at Time of Installation | ECT Manufacturer | Emissions Technology |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 25CU -401 | BXE11 | 1M2AC07C12M006618 | January 30, 2002 | Mack | 8 | Not Available | Argillon SINOx | SCR |
| | | | | January 1, 2004 | CRS | 14,236 | 1,745 | Engelhard DPX | DPF |
| 2 | 25CU -402 | ME11 | 1M2AC07C62M007019 | February 21, 2002 | Mack | 5 | Not Available | Argillon SINOx | SCR |
| | | | | January 6, 2003 | CRS | 8,437 | 1,074 | Engelhard DPX | DPF |

**Truck no. 25CU-402 was emissions tested at WVU, June '03 & June '04**

Appendix E, Table of SCR Installations, DSNY & UPS Fleets

# MACK RETROFIT PROGRAM

## UPS & DSNY SCR Installations = 10 Units

**SCR Systems -- Initial Installation**

| | | | | Installation | | Final Accounting | | | Accumulated |
|---|---|---|---|---|---|---|---|---|---|
| **No.** | **Fleet ID** | **VIN** | **Unit** | **Date** | **Miles** | **Date** | **Miles** | | **Miles** |
| 1. | UPS | 25211 | 265774 | February 1, 2002 | 35,960 | October 30, 2004 | 481,000 | estimated | 445,040 |
| 2. | UPS | 25212 | 265775 | January 29, 2002 | 12,577 | October 30, 2004 | 299,500 | | 286,923 |
| 3. | UPS | 25213 | 265776 | March 18, 2002 | 39,326 | October 30, 2004 | 311,954 | | 272,628 |
| 4. | UPS | 25214 | 265777 | March 19, 2002 | 44,889 | October 30, 2004 | 385,278 | | 340,389 |
| 5. | UPS | 25215 | 265778 | April 1, 2002 | 47,373 | October 30, 2004 | 342,880 | | 295,507 |
| 6. | UPS | 25216 | 265779 | February 21, 2002 | 38,016 | October 30, 2004 | 267,010 | | 228,994 |
| 7. | UPS | 25217 | 265780 | April 1, 2002 | 53,320 | October 30, 2004 | 419,000 | estimated | 365,680 |
| 8. | UPS | 25218 | 265781 | February 27, 2002 | 44,586 | October 30, 2004 | 415,085 | | 370,499 |
| 9. | DSNY | 1M2AC07C12M006618 | 25CU-401 | January 30, 2002 | 8 | October 30, 2004 | 20,000 | estimated | 19,992 |
| 10. | DSNY | 1M2AC07C62M007019 | 25CU-402 | February 21, 2002 | 5 | October 30, 2004 | 19,500 | estimated | 19,495 |
| | | | | | | | | | 2,645,147 |

**SCR Systems -- After Commissioning & Fully Functional**

| | | | | SCR Working Properly | | Final Accounting | | | Accumulated |
|---|---|---|---|---|---|---|---|---|---|
| **No.** | **Fleet ID** | **VIN** | **Unit** | **Date** | **miles** | **Date** | **Miles** | | **Miles** |
| 1. | UPS | 25211 | 265774 | November 2, 2002 | 143,065 | October 30, 2004 | 481,000 | estimated | 337,935 |
| 2. | UPS | 25212 | 265775 | August 8, 2002 | 54,986 | October 30, 2004 | 299,500 | | 244,514 |
| 3. | UPS | 25213 | 265776 | November 2, 2002 | 101,252 | October 30, 2004 | 311,954 | | 210,702 |
| 4. | UPS | 25214 | 265777 | November 2, 2002 | 125,031 | October 30, 2004 | 385,278 | | 260,247 |
| 5. | UPS | 25215 | 265778 | September 17, 2002 | 95,150 | October 30, 2004 | 342,880 | | 247,730 |
| 6. | UPS | 25216 | 265779 | September 17, 2002 | 92,266 | October 30, 2004 | 267,010 | | 174,744 |
| 7. | UPS | 25217 | 265780 | August 9, 2002 | 107,479 | October 30, 2004 | 419,000 | estimated | 311,521 |
| 8. | UPS | 25218 | 265781 | September 18, 2002 | 139,157 | October 30, 2004 | 415,085 | | 275,928 |
| 9. | DSNY | 1M2AC07C12M006618 | 25CU-401 | September 20, 2002 | 1,501 | October 30, 2004 | 20,000 | estimated | 18,499 |
| 10. | DSNY | 1M2AC07C62M007019 | 25CU-402 | September 20, 2002 | 1,446 | October 30, 2004 | 19,500 | estimated | 18,054 |
| | | | | | | | | | 2,099,874 |