



sanitation

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May 24, 2011

Honorable Michael Bloomberg
Mayor, City of New York
City Hall
New York, New York 10007

Honorable Christine Quinn
Speaker, New York City Council
City Hall
New York, New York 10007

Honorable John C. Liu
One Centre Street – Municipal Building
Room 530
New York, New York 10007

Re: Local Law 38 of 2005, Fifth Annual Report

Dear Mayor Bloomberg, Speaker Quinn, and Comptroller Liu:

I am pleased to submit to you the enclosed fifth annual report on the Department of Sanitation's alternative fuel program, as required by Local Law 38 of 2005 and Section 24-163.2 of the Administrative Code.

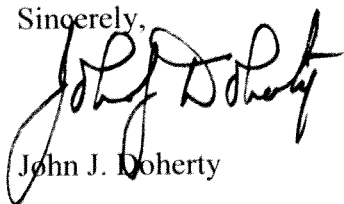
I am particularly proud to report that the Department's fleet is now among the cleanest and "greenest" in the world. Since 2005 *we have reduced our fleet's overall particulate matter (PM) emissions by 80%, and cut Nitrogen Oxide (NOx) emissions by 50%*. In fact, the new DSNY trucks delivered since late 2006 meet PM emissions standards that are *98% cleaner* than the unregulated diesels of old, and are as clean as trucks fueled by natural gas. Similarly, the new trucks delivered this year meet the 2010 NOx standard that is *98% cleaner* than the old diesels. In addition, all diesel fuel is ultra-low sulfur diesel (ULSD), with a maximum of just 15 parts per million (ppm) of sulfur, compared to the 2500 ppm of sulfur fuel that was the average content of highway fuel prior to 1993. The use of ULSD enables DSNY to implement our highly effective emissions retrofit program for pre-2007 model year trucks with best available retrofit technology (BART) such as diesel particulate filters, with complete fleet coverage on track for July 2012.

In an effort to further lower fleet emissions, including greenhouse gases, the Department currently uses B20 (20% Biodiesel made of soybeans) for its trucks in two districts, and B5 (5% Biodiesel) for all of its diesel trucks in the remaining districts.

In addition, we have 25 compressed natural gas (CNG)-powered street sweepers, 22 CNG-powered collection trucks, 296 light-duty vehicles powered by E85 ethanol, 530 light-duty vehicles that are hybrid-electric, two hybrid-hydraulic diesel collection trucks, and three hybrid-electric diesel collection trucks. As all of DSNY's diesel street sweepers now have BART retrofits or equivalent, CNG-fueled street sweepers offer minimal advantages over our Clean Diesel sweeper fleet.

The Department is committed to making its fleet as environmentally sustainable as possible consistent with our operational needs and cost constraints and will continue our active research and development efforts concerning alternative fuels and technologies for our fleet.

Sincerely,



John J. Doherty

c: Stephen Goldsmith, Deputy Mayor
City Hall

Haeda Mihaltses, Director
Office of Intergovernmental Affairs, City Hall

David Bragdon, Director
Office of Long Term Planning & Sustainability, City Hall

Hon. Letitia James, Councilmember
Chair, Committee on Sanitation & Solid Waste

Encl.



The City of New York Department of Sanitation



2010 Annual Report on Alternative Fuel Vehicle Programs Pursuant to Local Law 38 of 2005



2009: First Hybrid Hydraulic Collection Truck in North America

John J. Doherty, Commissioner
May 2011

DSNY Annual Report on Alternative Fuel Vehicle Programs Pursuant to LL38/2005

Introduction

The Department of Sanitation (DSNY) operates a sizeable fleet of trucks and other vehicles to carry out its assigned tasks under the City Charter of refuse and recyclables collection, street cleaning and snow removal. Such vehicle use necessarily produces air emissions, which have raised health concerns by members of the public. These concerns, in part, led to the enactment of Local Law 38 of 2005 (LL38/2005), which, among other things, directs DSNY to test alternative fuel street sweeping vehicles, and report annually on its use and testing of alternative fuel vehicles.¹ This report, which is submitted to the Mayor, the Comptroller and the City Council in accordance with LL38/2005, discusses the testing, analyses and assessments of DSNY's alternative fuel sanitation collection vehicles and street sweepers, and the feasibility of incorporating new alternative fuel sanitation vehicles and technology into DSNY's fleet. It also reviews the results of DSNY's pilot that used alternative fuel street sweeping vehicles in four sanitation districts, with one district in an area with high rates of asthma among residents.²

DSNY endeavors to operate its fleet in the most environmentally friendly manner, consistent with available resources, and therefore seeks to minimize emissions of concern from such operations, notably particulate matter (PM), nitrogen oxides (NOx), and greenhouse gases such as carbon dioxide.³ New York City's air quality has improved and in 2010 met federal standards for PM_{2.5}, but it remains out of compliance with standards for ozone. In 2010, DSNY's fleet included 2022 collection trucks, 450 street sweepers, and 190 dump trucks.⁴ Over the course of Fiscal Year 2010, the entire diesel fleet travelled approximately 25 million miles and required approximately 10 million gallons of diesel fuel. On average, a standard DSNY collection truck travelled approximately 6,900 miles, a DSNY dual-bin recycling collection truck: 9,300 miles, and a DSNY street sweeper: 4,800 miles. As discussed below, thanks to new technologies DSNY has achieved great success in minimizing emissions of PM and NOx from its fleet.

This report includes the total number of alternative fuel "sanitation vehicles" owned or operated by DSNY by type of alternative fuel used, discusses the notable advances in DSNY's clean diesel fleet, and provides information regarding DSNY efforts to further incorporate alternative fuel vehicles into its fleet. "Sanitation vehicles" are defined by LL38/2005 as

¹ NYC Administrative Code § 24-163.2(c)(1) & (2).

²This pilot was required by LL38/2005. *Id.*

³While not known to cause asthma, PM, especially fine PM 2.5 microns in diameter or smaller (PM_{2.5}) is associated with increased respiratory symptoms, while NOx can be a precursor in the formation of ground-level ozone (regional smog) which is associated with exacerbation of asthma-related symptoms. *Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements*, 66 Federal Register at 5012 (Jan. 18, 2001); "Public Health" chapter in *New York City Comprehensive Solid Waste Management Plan Final Environmental Impact Statement* (April 2005), available at <http://www.nyc.gov/html/dsny/downloads/pdf/swmp/swmp/swmp-5apr-feis/feis/chapter33.pdf>.

⁴ DSNY 2010 Annual Report, at 6.

vehicles used by DSNY “for street cleaning purposes or for the collection of solid waste or recyclable materials.”⁵

Dramatic Improvements in DSNY’s Fleet Emissions

DSNY’s fleet is already achieving an estimated *80% reduction in PM and a 50% reduction in NOx emissions* fleet-wide compared with DSNY’s fleet in 2005, while the newest trucks achieve *98% reductions* in each pollutant as compared with pre-1988 diesel engines.⁶

ULSD Fuel, New Vehicle Standards, Diesel Particulate Filters, and Retrofits

Currently all of the Department’s light, medium and heavy-duty diesel vehicles utilize the industry’s latest computer-controlled and regulated clean-diesel engines for their respective engine model years. DSNY has gone even further: its Clean Fleet Program of testing and development of state-of-the-art technology and alternative fuels helped pioneer the improvements in heavy duty diesel emissions that are now taking place nationwide. This Program includes obtaining research grants, partnering with industry to test vehicles under real world conditions, and operating a vehicle testing facility for heavy duty trucks.

- The Department pioneered the use of ultra-low sulfur diesel fuel (ULSD)—limited to 15 parts per million (ppm) of sulfur—a decade ago in certain districts and expanded its use to its entire fleet in 2004 in advance of the USEPA June 2006 nationwide ULSD mandate. The new standard represents a *reduction of 97%* from the previous low sulfur standard for on-road diesel fuel of 500 ppm that took effect in 1993. Prior to 1993, the average sulfur content for on-road diesel fuel was 2500 ppm.
- ULSD allowed DSNY to expand its use of various advanced emission-control after-treatment technologies, such as diesel particulate filters and diesel oxidation catalysts. Higher sulfur content fuel clogs these devices. These controls reduce particulate matter by 90% or better, as verified in DSNY testing.
- Since mid-2006, all of DSNY’s new diesel truck purchases have met the stringent 2007 USEPA new-truck standards limiting particulate matter to 0.01 grams per brake horsepower-hour (g/bhp-hr), *a reduction of 90% from the 2006 model year limit of 0.1 g/bhp-hr.*⁷ As of 2010 NOx is limited to 0.2 g/bhp-hr, compared to 2.0 g/bhp-hr in the 2006 model year and 4.0 g/bhp-hr in the 2003 model year. As DSNY’s collection trucks have a useful life of approximately seven years, fleet turnover results in the purchase of approximately 250 new trucks per year meeting these new-truck standards.

⁵ NYC Admin. Code § 24-163.2(a)(6).

⁶ Reduction in non-methane hydrocarbons is comparable, with 2010 standard of 0.14 g/bhp-hr, down from 0.5 g/bhp-hr in 2006 and 1.3 g/bhp-hr in 2003.

⁷ 66 Fed. Reg 5001, 5005 (Jan. 18, 2001). By comparison, the 1990 federal standard for particulate matter for heavy duty diesel highway engines was 0.60 g/bhp-hr. NOx standards have been reduced over time from 10.7 g/bhp-hr in 1988 to 0.2 g/bhp-hr starting in 2007, with a phase-in allowed until 2010, yielding an effective limit of 1.2 g/bhp-hr for 2007-2009 model years.

- To address the legacy of emissions from older trucks, DSNY mechanics have been installing Best Available Retrofit Technology (BART) devices such as particulate filters on pre-2007 trucks, as mandated by LL39/2005. For example, DSNY has installed 512 Cleaire Longview units that achieve reductions of 90% in PM and up to 25% in NOx. Including both factory-installed equipment and retrofits, by January 1, 2011 DSNY had particulate filters on 259 diesel-powered street sweepers and 1,536 collection vehicles. By July 2012, 100% of DSNY's pre-2007 diesel fleet will have BART retrofits.

The benefit of Clean Diesel technology in reducing emissions from DSNY's fleet has been profound, as recognized by the City's air quality experts at the Department of Environmental Protection (DEP), who oversee the review of air quality impacts of proposed actions. For example, DEP staff have determined that if an action resulted in fewer than 194 DSNY truck trips per hour with BART or 2007-compliant equipment on principal and minor arterials, expressways and limited access roads, then no further air analysis would be warranted to conclude that an action's impact to neighborhood PM_{2.5} levels along such roadways would be deemed insignificant.⁸ The DEP had previously determined in 2008 that the appropriate PM_{2.5} screening number without such retrofits would be 23 heavy duty diesel truck trips per hour on such roadways. The changes and improvements made to DSNY's Clean Diesel fleet have greatly reduced air quality concerns from mobile-source PM_{2.5}.

Alternative Fuel Vehicles

Despite the clear success of DSNY's Clean Diesel Program in minimizing fleet emissions, DSNY believes further improvements are possible as technology advances. DSNY therefore continues an active program of testing other kinds of fuels and technologies to determine whether further improvements in emissions and fuel mileage may be achieved at an acceptable cost. Under LL38/2005, "alternative fuels" include natural gas, liquefied petroleum gas, hydrogen, electricity, and any other fuel which is at least eighty-five percent, singly or in combination, methanol, ethanol, any other alcohol or ether.⁹ DSNY currently has over 872 vehicles that operate on various alternative fuels.

Compressed Natural Gas (CNG)

DSNY has 46 CNG vehicles in its active heavy-duty fleet, including collection trucks and street sweepers. DSNY has no light-duty CNG vehicles.

CNG Street Sweepers

DSNY operates 25 CNG street sweepers (see Appendix 1). As explained in last year's report, DSNY has discontinued the evaluation pilot study of CNG sweepers. Since 2007 DSNY has performed evaluations and assessments on the operation and reliability of CNG street sweepers versus conventional clean diesel street sweepers equipped with BART pursuant to local law. Based on the results, clean diesel street sweepers with BART appeared to be more reliable than CNG sweepers. As discussed below, CNG sweepers no longer offer a significant emissions

⁸ DEP communication, based on DSNY fleet in 2012.

⁹ NYC Administrative Code § 24-163.1(a)(1). Other types of fuels, such as B5 Biodiesel, do not qualify as alternative fuels.

advantage over new Clean Diesel sweepers. Furthermore, in the late fourth quarter of 2009, Cummins announced that it would no longer offer the current CNG engine for street sweepers because it does not meet the USEPA 2010 air emission standard for NOx. No other manufacturer makes a CNG engine of the size needed for DSNY's street sweepers. As DSNY has no viable option for new CNG street sweepers, DSNY ended the evaluation pilot study of CNG sweepers. The 25 CNG sweepers in the fleet will continue in service until they reach the end of their operational life of approximately 5 years.

CNG Collection Trucks

DSNY currently owns 21 dedicated CNG sanitation collection trucks (see Appendix 2). DSNY is phasing out its older fleet (2001-2003 vintage) of CNG collection trucks that have been problematic. CNG-fueled trucks are longer than conventional sanitation vehicles, making it more difficult to access narrower streets because of their wider turning radius.¹⁰ In Calendar Year 2008, DSNY put into service 10 new CNG collection trucks from Crane Carrier Corporation equipped with the new generation of the Cummins ISL-gas CNG engines to replace 10 of the oldest CNG trucks in the fleet. In Calendar Year 2009, DSNY put into service one front-loading Crane Carrier Corporation CNG collection truck equipped with a Cummins ISL-gas CNG engine. Also in Calendar Year 2009, DSNY ordered 10 additional CNG trucks from Crane Carrier Corporation, which were delivered in November/December 2009. In order to address the repeated failed cold starts of the fleet of Crane Carrier CNG trucks, Cummins made improvements to the engine calibration software. DSNY added the last 10 Crane Carrier CNG trucks to the fleet in the third quarter of Calendar Year 2010. The cold-weather operation of the newest CNG trucks with the Cummins ISL-Gas CNG engines so far has been satisfactory.

In an agreement with National Grid, DSNY also put into service one hybrid-hydraulic CNG collection truck in October 2010. The reliability of this truck so far has been acceptable; testing is on-going. Hybrid-hydraulic technology, which can be employed with any kind of fuel, is further discussed below.

CNG Fueling Facility

Under a federal consent order, DSNY built a fully-operational, heavy-duty vehicle CNG fueling station in Woodside, Queens, at a cost of approximately \$2,950,000.¹¹ This station went into service in May 2007 and provides shorter fueling times than other CNG fueling facilities.

Discussion: CNG vs. Clean Diesel

From an operational perspective, preliminary results on testing the latest generation of CNG collection trucks indicate they have improved in reliability from earlier model CNG trucks, but they are still not as reliable as clean diesel trucks. From an air emissions/public health perspective, CNG no longer offers a significant advantage over clean diesel. As a result of the use of ULSD and new emissions control technologies, heavy duty diesel truck particulate matter

¹⁰ Testimony of DSNY Deputy Commissioner Rocco DiRico to City Council Committee on Environmental Protection (September 23, 2004).

¹¹ This project was undertaken as part of a settlement of a lawsuit brought against the City and DSNY by the United States for violations of the Clean Air Act. *United States v. City of New York*, 99 Civ. 2207 (LAK) (S.D.N.Y.).

emissions are very low, and are comparable to those from CNG-fueled heavy duty vehicles. Nitrogen oxide emissions from the two technologies are also comparable, with CNG truck NOx emissions slightly lower than the NOx emissions from diesel trucks with advanced after-treatment technologies.¹² On the other hand, greenhouse gas emissions from CNG trucks are reportedly 20-23% lower than those from diesel trucks.¹³ It has been noted that CNG trucks are somewhat quieter than diesel trucks,¹⁴ but compaction noise from CNG collection trucks and diesel collection trucks seems generally comparable. CNG trucks emit more methane (a significant greenhouse gas) and carbon monoxide than conventional clean diesel vehicles.¹⁵

From an economic perspective, with increased recoverable domestic reserves due to new technology natural gas prices have fallen below current diesel prices and may offer stability advantages. As of January 1, 2011, a gallon of diesel fuel cost \$3.39 while a gallon-equivalent of CNG cost approximately \$2.54, offering a potential savings in fuel costs for CNG trucks at such prices. However, CNG-fueled vehicles have lower fuel efficiency. In addition, a CNG-fueled collection truck costs approximately \$65,000 more per unit than a diesel collection truck. DSNY has only one CNG fueling station for its 59 district garages, and the handful of private CNG filling stations in the City are generally not equipped for rapid filling of heavy duty trucks. Thus any move to significantly expand DSNY's CNG truck fleet would likely require additional investment in capital funds to build CNG fueling infrastructure and in facility modifications as required by the building code.

E85 Ethanol Blend Vehicles

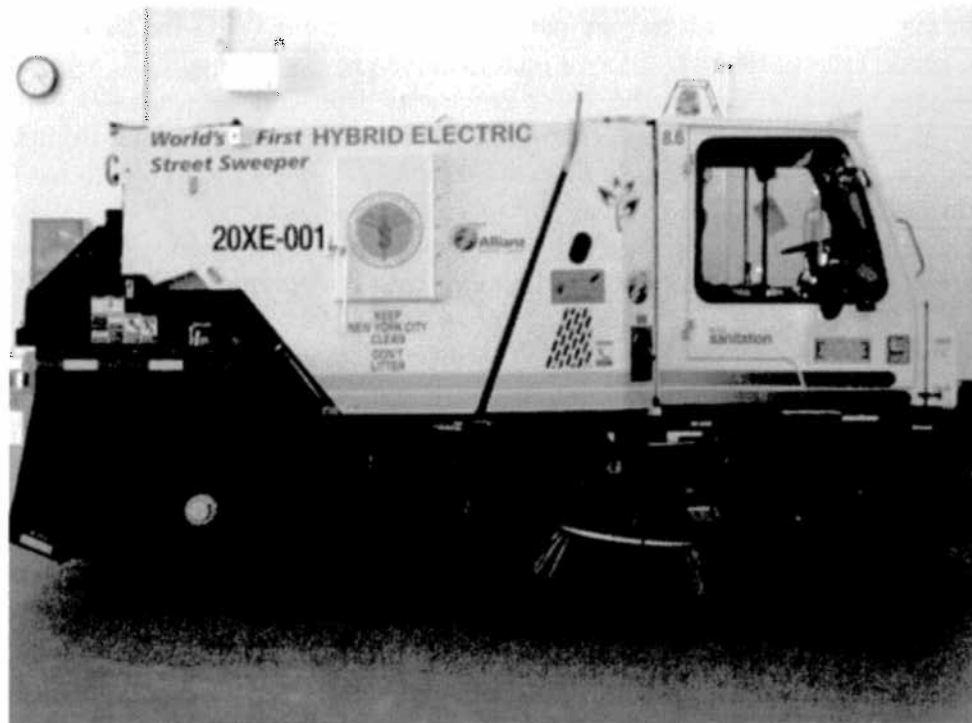
Currently, 296 DSNY light-duty "flex fuel" vehicles run on E85, which is a mixture of 85% corn-based ethanol and 15% gasoline. These consist of Ford Taurus sedans and Ford Explorer sport utility vehicles. There are five E85 fueling facilities citywide. DSNY was the first city agency to use E85 ethanol fuel in its fleet. While the operation of these vehicles has generally been satisfactory, they do not achieve significant emissions savings over gasoline vehicles, although NOx emissions are somewhat lower. Fuel mileage is less than with gasoline. In cold weather, these vehicles have used a blend of 70% ethanol and 30% gasoline, to improve operation. Some studies suggest that production of ethanol consumes more energy than it produces, while others indicate a positive energy balance of about 35%. Therefore, greenhouse gas reductions with the use of corn-based E85 as compared to gasoline do not appear to be compelling on a life-cycle basis. Consistent with the prohibition on purchasing new bi-fuel vehicles in LL38/2005, DSNY does not plan to expand its fleet of E85 vehicles, but will operate them until they complete their useful life.

¹² See Ayala, *et al.*, *CNG and Diesel Transit Bus Emissions in Review* (August 2003); Ayala, *et al.*, *Diesel and CNG Heavy-Duty Transit Bus Emissions over Multiple Driving Schedules: Regulated Pollutants and Project Overview* (Society of Automotive Engineers, 2002).

¹³ Peter Hildebrandt, "NGVs & Onboard Equipment," *MSW Management*, March/April 2011, *NGV Fleet Manager Supplement*, at 14 (citing figures from Clean Vehicle Education Foundation).

¹⁴ INFORM, Inc., *Greening Garbage Trucks: New Technologies for Cleaner Air* (2003).

¹⁵ DSNY Commercial Waste Management Study, Vol. VI, at ES-5, 23 (March 2004); Ayala, *et al.*, *Diesel and CNG Heavy-Duty Transit Bus Emissions over Multiple Driving Schedules* (indicating CNG buses emit more carbon monoxide than retrofitted diesel buses).



Hybrid-Electric Light-Duty Vehicles and Sweepers

DSNY has 530 hybrid-electric light-duty vehicles, with such models as the Toyota Prius sedan and Ford Hybrid Escape SUV. These vehicles operate on gasoline assisted by battery technology, and can convert and store energy captured from braking. The performance of these vehicles has been good, with significantly improved gas mileage and lower emissions than standard gasoline vehicles, despite higher initial vehicle costs than a comparably-sized gasoline model. Consistent with LL38/2005, DSNY expects to increase its fleet of these vehicles.

DSNY is currently testing two diesel-powered hybrid-electric street sweepers in two districts (see photo above). These vehicles have the potential of even lower emissions and better fuel mileage than the latest Clean Diesel engines.

Hybrid-Electric and Hybrid-Hydraulic Diesel Collection Trucks

DSNY ordered two experimental hybrid-hydraulic diesel trucks and three experimental hybrid-electric diesel trucks from Crane Carrier Corporation in 2008, which were put into service in October 2009 and June 2010, respectively (see photo on cover and Appendix 3). This initiative was sponsored by the New York State Energy Research and Development Authority and the Hybrid Truck Users Forum. The hybrid-hydraulic diesel trucks are made with technology from Bosch Rexroth, called the Hydrostatic Regenerative Braking (HRB) System. These are the first such trucks in North America; they have also been tested in Germany. These two different hybrid technologies have the potential to reduce fuel use and related emissions as by capturing and reusing energy that is otherwise wasted during the frequent braking of collection vehicles. As noted above, DSNY also put into service one hybrid-hydraulic CNG

collection truck in October 2010. Upon completion of pilot testing, in December 2010 DSNY returned a fourth hybrid-electric diesel truck to the manufacturer, Mack Trucks.

Thus far, the hybrid-hydraulic diesel collection trucks have outperformed the hybrid-electric diesel collection trucks, with less downtime. DSNY's testing of this first generation hybrid-hydraulic technology indicated a fuel savings of approximately 12% and a savings in brake replacement frequency and associated labor. DSNY mechanics are already familiar with servicing hydraulic technology from standard rear-loading collection trucks that have hydraulic compaction systems, which helps minimize retraining needed for the new technology. The trucks were also found to result in less braking "squeal" noise than from conventional diesel collection trucks. Following successful testing in 10 European cities and New York City, the manufacturer put the hybrid-hydraulic technology into mass production in October 2010. As a result, the cost of hybrid-hydraulic technology has dropped significantly and when applied to a diesel truck it is now competitive with CNG trucks. Accordingly, DSNY has ordered 10 more next-generation Bosch Rexroth hybrid-hydraulic trucks in FY2011 with delivery expected by the end of December 2011, and plans to purchase at least 15 more in FY2012. It is hoped that fuel and emissions savings with the newest model will be even greater than with the first generation technology, and may approach 20 to 25%.

Electric Vehicles

In FY2012 DSNY plans to purchase and test seven plug-in hybrid-electric Chevrolet Volt sedans, which are capable of running entirely on battery power for up to 40 miles before a gasoline engine starts up to charge the battery. DSNY will also purchase and test two Ford Transit Connects (pure plug-in electric), and six plug-in, hybrid-electric aerial bucket work trucks. In addition, DSNY will test the first diesel-powered hybrid-electric box truck in the nation.

DSNY intends to conduct further studies on the economic and operational feasibility of incorporating more alternative fuel sanitation vehicles into its fleet.

Testing of Biodiesel Blends

DSNY is further developing its clean air efforts by implementing advanced technologies to reduce emissions and utilizing clean diesel fuel with a renewable alternative biofuel component. For example, in March 2007, DSNY launched a biodiesel (B5) initiative citywide on all diesel-powered equipment (on-highway and off-highway), utilizing 5% biodiesel (made from soybeans) and 95% (petroleum-based) ULSD. To date, the B5 initiative resulted in no change in vehicle performance, no operator or mechanic complaints, no increase in down rate, and good winter operability. In August 2007, DSNY implemented its B20 (20% biodiesel) pilot study in the Queens 6 district and based on those encouraging results, in July 2010 DSNY expanded the study to the Brooklyn 5 district. Testing in both districts is on-going. B5 biodiesel costs about the same as standard ULSD, while B20 biodiesel costs somewhat more.

Conclusion

As a result of dramatic improvements in clean diesel technology, federal mandates for ultra-low sulfur diesel fuel, much stricter new vehicle emission standards, local law BART

requirements for pre-2007 trucks, and DSNY's efforts, DSNY has already cut its overall diesel fleet PM emissions by approximately 80% and NOx emissions by half since LL38/2005 was passed, with further reductions expected as the fleet turns over.

DSNY will continue participating in research and development of new technologies and evaluate the mechanical reliability and operability of CNG and other alternative fuel collection trucks to assess their respective environmental and economic performances. DSNY is currently testing two diesel-powered hybrid-electric street sweepers in two districts and is committed to exploring fully the costs and benefits of incorporating hybrid collection trucks into its fleet. DSNY's B5 initiative citywide has met with positive results and testing of the B20 initiative is ongoing and has expanded to two districts. This initiative has the potential to further reduce truck emissions, including greenhouse gases.

* * *

This report was written by Steven Brautigam, Assistant Commissioner for Environmental Affairs, and Kate Grunin, Associate Counsel, DSNY Bureau of Legal Affairs, who wish to thank Rocco DiRico, Deputy Commissioner for Support Services, and Spiro Kattan, Supervisor of Mechanics, for their cooperation and helpful comments.

* * *

Appendix 1: DSNY CNG Fuel Street Sweepers

VehicleID	VIN #	Vehicle Type	Make / Model
20CNG-501	1J9VM4L903C172001	Street Sweeper	Johnston 4000
20CNG-502	1J9VM4L923C172002	Street Sweeper	Johnston 4000
20CNG-503	1J9VM4L943C172003	Street Sweeper	Johnston 4000
20CNG-504	1J9VM4L963C172004	Street Sweeper	Johnston 4000
20CNG-505	1J9VM4L983C172005	Street Sweeper	Johnston 4000
20CNG-601	1J9VM4L956C172001	Street Sweeper	Johnston 4000
20CNG-602	1J9VM4L976C172002	Street Sweeper	Johnston 4000
20CNG-603	1J9VM4L996C172003	Street Sweeper	Johnston 4000
20CNG-604	1J9VM4L906C172004	Street Sweeper	Johnston 4000
20CNG-605	1J9VM4L926C172005	Street Sweeper	Johnston 4000
20CNG-606	1J9VM4L946C172006	Street Sweeper	Johnston 4000
20CNG-607	1J9VM4L966C172007	Street Sweeper	Johnston 4000
20CNG-608	1J9VM4L986C172008	Street Sweeper	Johnston 4000
20CNG-609	1J9VM4L9X6C172009	Street Sweeper	Johnston 4000
20CNG-610	1J9VM4L966C172010	Street Sweeper	Johnston 4000
20CNG-701	1J9VM4L988C172111	Street Sweeper	Johnston 4000
20CNG-702	1J9VM4L9X8C172112	Street Sweeper	Johnston 4000
20CNG-703	1J9VM4L918C172113	Street Sweeper	Johnston 4000
20CNG-704	1J9VM4L938C172114	Street Sweeper	Johnston 4000
20CNG-705	1J9VM4L958C172115	Street Sweeper	Johnston 4000
20CNG-706	1J9VM4L978C172116	Street Sweeper	Johnston 4000
20CNG-707	1J9VM4L998C172117	Street Sweeper	Johnston 4000
20CNG-708	1J9VM4L908C172118	Street Sweeper	Johnston 4000
20CNG-709	1J9VM4L9X8C172109	Street Sweeper	Johnston 4000
20CNG-710	1J9VM4L968C172110	Street Sweeper	Johnston 4000

Appendix 2: DSNY's CNG Collection Trucks

Vehicle ID	Make / Model	Vehicle Type	VIN #
24CNG-001	Crane Carrier LET2	Front Loading	1CYCCZ4848T048392
25CNG-501	Crane Carrier LET2	Rear Loading	1CYCCZ4868T048393
25CNG-502	Crane Carrier LET2	Rear Loading	1CYCCZ4868T048569
25CNG-503	Crane Carrier LET2	Rear Loading	1CYCCZ4828T048570
25CNG-504	Crane Carrier LET2	Rear Loading	1CYCCZ4848T048571
25CNG-505	Crane Carrier LET2	Rear Loading	1CYCCZ4868T048572
25CNG-506	Crane Carrier LET2	Rear Loading	1CYCCZ4888T048573
25CNG-507	Crane Carrier LET2	Rear Loading	1CYCCZ48X8T048574
25CNG-508	Crane Carrier LET2	Rear Loading	1CYCCZ4818T048575
25CNG-509	Crane Carrier LET2	Rear Loading	1CYCCZ4838T048576
25CNG-510	Crane Carrier LET2	Rear Loading	1CYCCZ4858T048577
25CNG-601	Crane Carrier LET2	Rear Loading	1CYCCZ4819T049419
25CNG-602	Crane Carrier LET2	Rear Loading	1CYCCZ4889T049420
25CNG-603	Crane Carrier LET2	Rear Loading	1CYCCZ48X9T049421
25CNG-604	Crane Carrier LET2	Rear Loading	1CYCCZ4819T049422
25CNG-605	Crane Carrier LET2	Rear Loading	1CYCCZ4839T049423
25CNG-606	Crane Carrier LET2	Rear Loading	1CYCCZ4859T049424
25CNG-607	Crane Carrier LET2	Rear Loading	1CYCCZ4879T049425
25CNG-608	Crane Carrier LET2	Rear Loading	1CYCCZ4899T049426
25CNG-609	Crane Carrier LET2	Rear Loading	1CYCCZ4809T049427
25XG-001	Crane Carrier LET2	Rear Loading	1CYCCZ48X9T049418

Appendix 3: DSNY's Hybrid Collection Trucks

# of Units	Chassis Mfg	Fuel	Hybrid Sys	Series/Parallel	# of Units in Service
3	Crane Carrier Corp	Diesel	Electric	Series	3
2	Crane Carrier Corp	Diesel	Hydraulic	Parallel	2
1	Crane Carrier Corp	CNG	Hydraulic	Parallel	1

