Testimony of

Rohit T. Aggarwala
Director of Long-Term Planning and Sustainability
City of New York

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Respecting Proposed Intro 622-A

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Good afternoon, Chairman Gennaro and Members of the Committee, I am Rohit Aggarwala, Director of the Mayor's Office of Long Term Planning and Sustainability and with me today is Kizzy Charles-Guzman, Policy Advisor for Air Quality, from my staff. Thank you for inviting us here today to testify on Proposed Intro 622-A which relates to the retirement and retrofit of diesel fuel-powered school buses. This bill would achieve one of our PlaNYC initiatives, and we have appreciated the opportunity to work with the Council on this important legislation.

The NYC school bus fleet is comprised of approximately 8,000 vehicles privately owned by 52 different bus vendors under contract with the New York City Department of Education (NYC DOE). To understand this particular sector we must clarify that school buses are divided into two types (large and small) with 4 subtypes—Types C and D buses are large yellow buses with a gross vehicle weight rating greater than 10,000 pounds and seating twenty to ninety passengers; and Types A and B buses are small buses—typically mini-wagons and mini-ramps.

The City's school bus fleet is also subdivided between those buses that transport General Education students and buses that transport Special Education and Pre-Kindergarten students. As you can see from Table 1, the majority of the vehicles (6,125) are diesel powered and 2,655 are gasoline powered. Of the diesel buses, 2,315 buses transport General Education students and 3,810 transport Special Education and Pre-Kindergarten students. Together, the school bus fleet services 140,000 students every day.

Bus Program	Bus Type	Mandate	Diesel-Powered	Gasoline-Powered	Total Fleet
General Ed	Large (C&D)	Local Law 42	2,315	0	2,315
Special Ed	Large	Intro 622A	1,881	0	1,881
Special Ed	Small (A&B)	Intro 622A	1,133	2,469	3,602
Pre-K	Large	Intro 622A	353	71	424
Pre-K	Small	Intro 622A	443	115	558
Total			**6,125**	**2,655**	**8,780**

Table 1: New York City school bus fleet inventory

Gasoline-powered buses are not the subject of this testimony as gasoline vehicles are significantly cleaner than diesel vehicles in terms of emissions. The principal pollutants of concern from diesel school bus engines are fine particulate matter ($PM_{2.5}$) and nitrogen oxides (NOx). Thus, the rest of this testimony describes the fleet of diesel buses and the City's efforts to address these two pollutants of concern.

The New York City school bus fleet is comprised of relatively new buses—over half of the fleet is newer than 10 years old. Analysis of the fleet inventory shows variation in the age of the school buses, with the average fleet age at 9 years. As depicted in Table 2 below, 11% of the fleet (677 buses) are older than 1994. This sector is responsible for a significant amount of air pollution because new standards from the U.S. Environmental Protection Agency (EPA) came into effect for the 1994 model year; while these were not as stringent as the newest standards that took effect in 2007, they make the pre-1994 buses responsible for a highly disproportionate amount of pollution.

Also note from Table 2 that 10% percent of the fleet (601 buses) is comprised of new buses meeting the recent 2007 U.S. EPA heavy-duty engine standards for particulate matter ($PM_{2.5}$), and the remaining 79% meets at least 1994 federal standards for heavy-duty diesel engines for $PM_{2.5}$, which were effective until 2006.

	Pre-1994	**1995-2006**	**2007 and newer**	**Total**
Number of buses	677	4,847	601	6,125
% of diesel fleet	11%	79%	10%	100%

Table 2: New York City school bus fleet EPA heavy-duty engine emission categories

From an air emissions perspective, pre-1994 buses emit 60 times more particulate matter, 9.3 times more hydrocarbons and 53.5 times more nitrogen oxides—all criteria pollutants with impacts on public health and environmental quality—than 2007 model year buses. After assessment of many pollution control measures, it is clear that to address its $PM_{2.5}$ emissions the pre-1994 school buses are the most important targets. Federal $PM_{2.5}$ emissions standards for heavy duty diesel engines were strengthened in 1991, 1994 and 2007. Emissions of nitrogen oxides (NO_X), ozone precursors, are also important to consider in light of the City's non-attainment of federal ozone standards. The U.S. EPA strengthened the standard for NO_X in 1998 and combined the NO_X standards with the standard for hydrocarbon (HC) in 2004, which is another ozone precursor. Only 29% of the fleet meets the 2004 or later standards for these pollutants. Thus, fleet turnover strategies are critical in achieving the greatest reductions in emissions of $PM_{2.5}$ and NO_X especially if focused on pre-1998 buses.

Besides the enactment of strict federal standards, $PM_{2.5}$ and NOx emissions from school buses are further addressed through various techniques, which I will describe below. As with all diesels, improvements have three interdependent components: improved engines that meet updated emissions standards (new buses), filters and emissions control devices on the exhaust system, and fuel with lower sulfur content. Since 2005, New York City school buses have been required to use Ultra Low Sulfur Diesel fuel (ULSD) and, in 2007 a rule issued by the U.S. EPA

essentially began to remove non-ULSD fuel from the US transportation diesel fuel market. Thus, the entire diesel school bus fleet uses ULSD. Having implemented this particular control measure, I will now emphasize the City's efforts to install devices to control air pollutants from school buses, given their unique operating conditions.

There are two main types of technologies that control tailpipe soot emissions: Diesel Oxidation Catalysts (DOCs) and Diesel Particulate Filters (DPFs).

DOCs are devices that break down pollutants in the exhaust into less harmful components, reducing $PM_{2.5}$ emissions by 20-24%. DOCs range in price from $2,000 to $4,000, can be installed on any diesel engine, and run on regular diesel fuel. A DOC requires minimal maintenance and has a life span of 7-15 years.

DPFs are ceramic devices that collect the exhaust's soot and, using the high exhaust temperature to heat the ceramic structure, break down or oxidize the PM into less harmful components. Passive DPFs can be installed on new or used buses that meet a high temperature profile, but must be used with ULSD fuel. Active DPFs do not require buses to meet a high temperature profile as they contain equipment that retains exhaust heat thereby ensuring that it reaches the required levels. The combination of DPFs and ULSD can reduce emissions of PM by at least 85%. DPFs range in price from $7,500 for passive systems to $18,000 for active systems, require maintenance with each oil change and most have a life span of 15 years or more. Though highly effective at reducing PM emissions, DPFs require data-logging and customized engineering for installation and they perform best in post-1994 buses. Passive DPFs are not suitable as an emissions reduction technology for some applications because of the case-by-case temperature profile review required for their proper installation. In addition, a detailed inventory of the bus fleet's engines (make, model, and year) and an assessment of duty-cycles are also important elements in this case-by-case review. DPFs will be factory-installed on the buses compliant with the recent 2007 EPA diesel engine emissions standards.

One additional system focuses on capturing emissions not from the tailpipe, but from the engine of school buses—a closed crankcase ventilation system (CCVS). A small but significant amount of exhaust vapor leaks out from the engine and is vented to the atmosphere through the bus crankcase. These engine emissions contain pollutants from diesel combustion such as soot and hydrocarbons. These emissions make their way into passenger compartments of trucks and buses, concentrating in intensity and significantly exposing children and school bus drivers. Several studies have shown that pollutant concentrations can be up to four times higher inside of the school bus cabin than ambient levels at the tailpipe of the bus. Overwhelming evidence links diesel exhaust as harmful to human health in general, posing even higher risks for children.

Buses with 1994 and newer engines, while in motion, emit approximately 25% of their total emissions from the crankcase and 75% from the tailpipe. Crankcase emissions typically contribute to a higher percentage (up to 50%) of total engine emissions when the engine is idling. Crankcase emissions from diesel engines without controls can be substantial even on relatively recent model year engines, and concentrate inside the school bus cabin whenever the windows are kept shut.

The crankcase systems reroute crankcase ventilation gases from the breather tube back into the engine intake airflow to be used for combustion. These systems include condensation filters to remove the oil and particulates, pressure regulators to protect the engine and ductwork to route the filtered gases back through the engine instead of to the atmosphere. The system eliminates 100% of the crankcase emissions and therefore the 25% of the engine's relative contribution to the overall bus emissions during all engine-operating modes. These systems have been verified for on-road applications by both the U.S EPA and the California Air Resources Board (CARB) in combination with a tailpipe retrofit.

Having described the various options available for controlling air pollution from school buses, I will now delve into the current efforts undertaken by the City and will comment on the legislation proposed today.

The focus of school bus retrofits, as with NYC Local Law 42 of 2005, has been on diesel-fueled Types C and D buses (See Table 1 above). Our fleet inventory indicates that Types C and D buses covered under Local Law 42 comprise about 38% (2,315 buses) of the total diesel fleet. NYC Local Law 42 of 2005 mandates the installation of Best Available Retrofit Technologies and the use of ULSD on all large buses servicing general education students. Local Law 42 does not apply to the fleet's small and large diesel-fueled school buses that are used for special education and Pre-K transportation purposes.

In compliance with Local Law 42 of 2005, which had an aggressive compliance schedule, the NYC DOE coordinated the installation of Diesel Oxidation Catalysts (DOCs), to reduce up to 25% of soot pollution. At the time, DOCs were the only tested retrofits that worked on the school buses given the fleet's operating conditions in the City's stop-and-go traffic. Passive Diesel Particulate Filters (DPFs) were the only filters available in the market proven to reduce up to 85% of soot pollution at that time. Because the lengths of bus routes vary greatly, the routes themselves are subject to change and buses are not exclusively assigned to specific routes, a passive system could not reliably and consistently generate adequate exhaust heat to be effective in reducing particulate matter. Thus, the City was unable to install DPFs at that time.

To date, all school buses covered by Local Law 42 of 2005 have been equipped with DOCs and with crankcase ventilation systems, which as described above eliminate 100% of the engine emissions that seeps inside the school bus cabin. Seven school buses covered by Local Law 42 are equipped with DPFs, and bus vendors report that 353 buses are 2007 Model Year or newer, and thus have factory-installed tailpipe and crankcase filters.

Furthermore, in addition to retrofitting all of its general education buses, the NYC DOE voluntarily planned to retrofit large special education buses. In 2007, the NYC DOE also began a pilot program to test the operation of active DPFs on five buses. I will address the expansion of this pilot program in a later section of this testimony, but I would like to emphasize that as a result of these voluntary pollution reduction measures, our goal was to install a tailpipe retrofit (including DOCs or active DPFs) in over 60% of the Special Education and Pre-K fleets independently of Local Law 42. The City has already installed tailpipe retrofits on 20% of the Special Education fleet.

Still, the City can do more to clean up the diesel school bus fleet in order to protect public health and the environment. The current NYC DOE contract with school bus vendors allows the provision of buses with model years 1987 and newer. There are also vintage requirements for each bus vendor to meet as a percentage of their contracted fleet but replacement buses are allowed to be up to five years old. The current contract's vintage requirements roughly translate into a 19 or 20 year retirement age. However, this contract is set to expire in 2010.

Analysis of the fleet inventory showed that the years preceding a tightening of EPA's heavy-duty engine standards for $PM_{2.5}$, such as 1990 or 2006, are associated with a concentration of buses of that model year. That is, under the language in the current NYC DOE contract, and given the lack of pre-existing, city-wide legislation to regulate the age of the buses, school bus vendors do not have an incentive to purchase the newest buses to service New York City. Further, the most basic retrofit technologies work best on buses manufactured after 1994 thus, the imperative is to get rid of the oldest, dirtiest buses on the fleet first, and then to continue to retrofit buses expected to be on the road for more years such as those manufactured between 1998 and 2006.

Given this landscape, the City strongly supports Introduction 622-A, which would institute a mandatory 16-year retirement age and a mandatory requirement that bus vendors install closed crankcase ventilation systems on all diesel buses that contract with the NYC DOE.

The requirements are effective July 1st, 2010 and replacement buses must comply with the latest U.S. Environmental Protection Agency (EPA) diesel engine emission standards.

We support Intro 622-A's requirement for a uniform school bus retirement age of 16 years to meet the goal of getting rid of the oldest, dirtiest buses first—and as quickly as possible. Unlike previous proposals suggesting varying retirement ages for buses depending on the type of retrofit technology installed, a uniform retirement age for all diesel-fueled buses will facilitate inspecting, accounting and reporting.

The U.S. EPA did not lower particulate matter heavy-duty engine standards for particulate matter emissions between 1994 and 2007. That means that a school bus with 1997 model year emits just as much soot as a 2005 school bus. A retirement age of 12 or 14 years would not yield significant additional $PM_{2.5}$ reduction benefits, and only modestly decrease NO_X and hydrocarbon emissions, while severely impacting the availability of enough vehicles to fulfill existing school bus routes. For example, enacting a 12 year retirement age would mean the immediate retirement of 2,085 buses—34% of the fleet. We believe it would be impossible to procure, inspect, and deploy that many buses following the expiration of the current school bus contract and on time for the beginning of the following school year. A 16-year school bus retirement age is operationally feasible, economically prudent, and environmentally sound.

Intro 622-A's requirement to replace the oldest buses on the fleet with buses meeting the latest EPA diesel engine emission standards will immediately result in a 90% cleanup of the11% of the fleet that produces the disproportionate share of emissions. This is because all buses with model year 2007 and later come equipped with diesel particulate filters to significantly decrease $PM_{2.5}$ tailpipe emissions and also with crankcase controls to prevent emissions from entering the school bus cabin.

We support Intro 622-A's requirement that closed crankcase ventilation systems be installed on all buses—large and small—that contract with the NYC DOE to service New York

City students. We believe that this proposal is a cost-effective way to protect the health of children and bus drivers riding to and from our schools.

Finally, I'd like to briefly elaborate on a voluntary retrofit program being managed by the NYC DOE to further address emissions from the Special Education and Pre-Kindergarten school buses. After being awarded a Congestion Mitigation and Air Quality (CMAQ) grant, NYC DOE will be managing the installation of 515 active DPFs starting in 2009. This grant will target buses with model years between 1998 and 2006; as such an investment should focus on buses that will not be retired within 3 years. This project is an expansion of the 5-bus active DPF pilot program that I mentioned at the start of this testimony and will result in a 42% reduction in soot emissions (1.36 tons of $PM_{2.5}$) from this sector of the fleet.

The City is committed to continue to fundraise to ensure that all buses receive active DPFs over time and to continue its search for cutting-edge technology to address the emissions of the school bus fleet. While the City is pioneering advanced technologies, we must remember that the realities of the school bus market pose unique challenges. The City is committed to making prudent investments in pollution reduction policies and to ensuring the safe and reliable operation of its fleets.

Because federal policy prohibits the U.S. EPA from funding diesel reduction projects that are required by local mandates, mandatory retrofit requirements for all school buses, as required by Local Law 42, have rendered the City ineligible for federal funds for retrofits The high cost of bus retrofits and the large size of the diesel school bus fleet means that the City should do as much as possible to remain eligible to Federal and State grants. We will continue to apply for independent grant programs whenever possible to continue to reduce emissions on a shorter schedule.

In conclusion, Intro 622-A reflects what we believe to be the optimal strategy. It will get the dirtiest buses out of the fleet as soon as possible; it will require a comprehensive installation of the crankcase filters that will achieve the most important task, of protecting children from

pollution in the closed confines of the bus itself. And, as written, it avoids forcing a replacement schedule that would be impractical or closing off our eligibility to use Federal funding for DPF installation. This approach that prudently invests public funds to achieve the maximum health and environmental benefit possible is precisely consistent with PlaNYC.

We urge you to pass Intro 622-A as soon as possible. We look forward to working with the Council on this legislation and at this time we would be happy to answer any questions that you may have.

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on Int. No. 622-A Res. No. _____

☑ in favor ☐ in opposition

Date: 9/8/09

(PLEASE PRINT)

Name: Rohit Aggarwala

Address: _____

I represent: Mayor's Office - Long-term Planning & Sustainability

Address: 253 Broadway 10th Fl.

Please complete this card and return to the Sergeant-at-Arms