



# MEMO

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**To:** School Bus Subcommittee  
**From:** Madeleine Weil, Environment Northeast  
**Date:** September 27, 2005  
**Re:** School Bus Options Menu

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## Purpose

This memo outlines several potential policy options for cleaning up school bus emissions in Connecticut. We hope to elicit feedback from the committee about the proposed mechanics, costs/benefits, opportunities/pitfalls and we're looking forward to a constructive discussion.

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## Introduction

More than 387,000 children ride the bus to school each day in Connecticut. The length of time spent on buses varies from 20 minutes per day to several hours. A child with a 30 minute trip to and from school each day spends 180 hours on a school bus each school year. Cumulatively, Connecticut school children spend more than 50 million hours on school buses each year.<sup>1</sup>

Medical studies show that children are particularly vulnerable to the health impacts of diesel fine particulate matter. Fine particles have been linked to serious health impacts in children such as slowed growth in lung function, increased emergency room visits, increased incidences of asthma and bronchitis, as well as increased prevalence of asthma attacks and allergic symptoms. The lifetime prevalence rate of asthma among Connecticut's children is 13%, among the highest in the country. In Connecticut's cities, the rate is even higher.

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<sup>1</sup> Environment & Human Health, Inc., *Children's Exposure to Diesel Exhaust on School Buses*, (2002).

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Because the negative health impacts of diesel particulate matter are well documented (particularly the impacts on children), US EPA recently adopted engine emission standards that will dramatically reduce emissions from new engines. Beginning with MY2007, federal law requires that all new school buses will come equipped with diesel particulate filters and closed crankcase ventilation systems, and will meet an OEM PM emission standard of 0.01 g/bhp-hr. This is the most stringent level of protection from emissions possible with today's diesel technology, comparing favorably even with alternative fuels like compressed natural gas.

Over time, Connecticut's school bus fleet will become cleaner as older school buses are phased out and replaced by buses compliant with the MY2007 emission standard. Typically, Connecticut school buses are less than 10 years old, with older outliers in less affluent districts such as Hartford. The Hartford school bus fleet, for instance, currently includes buses up to 14 years old (MY1991). Given these trends, under a business-as-usual scenario, children in districts with older buses may not be protected until 2020 or after. It will be 2012-2014 before the majority of Connecticut school children are protected from diesel pollution to the full extent possible with today's technology.

A large body of scientific and medical research has conclusively demonstrated that a) diesel pollution causes serious health problems, b) children are exposed to high levels of diesel pollution on school buses, and c) children are particularly susceptible to health impacts from diesel pollution. With these things in mind, the CT Legislature passed Special Act 05-7, instructing the DEP to develop a diesel emission reduction strategy. The Act specifies that the strategy must contain:

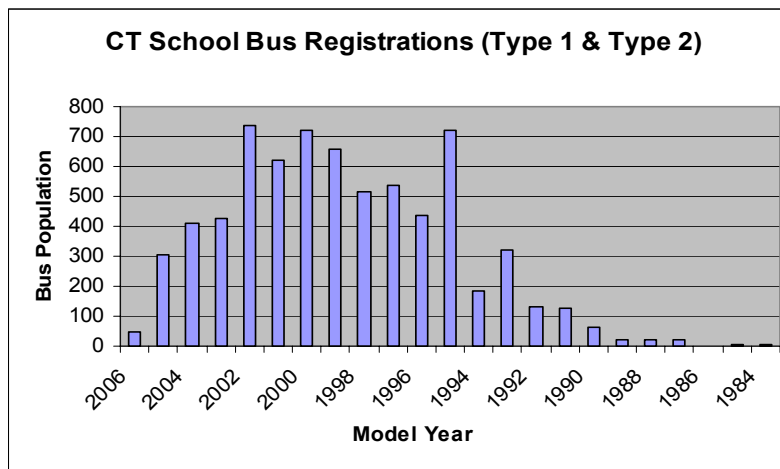
*“An implementation strategy, and an estimate regarding the cost and benefits to the state or municipalities of implementing such strategy, to maximize, not later than December 31, 2010, diesel particulate matter emission reductions from school buses and to prevent by said date diesel particulate matter engine emissions from entering the passenger cabin of the buses;”*

This Act essentially speeds up the timeframe for achieving the PM reductions that would eventually happen through a business-as-usual fleet turnover schedule under EPA regulations, essentially ensuring that by 2010, all Connecticut school buses will have stringent pollution control technology.

Connecticut's School Bus Fleet

Currently, 5486 Type 1 (full size) and 1544 Type 2 (half-size) school buses are registered to transport students in Connecticut according to the Connecticut Department of Motor Vehicles. All of the Type 1 buses and approximately 35% (535) of the Type 2 buses use diesel fuel. 90% are owned by private bus companies and contracted out for student transport by school districts and the remainder are owned by municipalities or school districts. The Connecticut School Transportation Industry Association has 92 member bus companies that do business in the state of Connecticut (including municipal members).

The age profile for the Connecticut school bus fleet is below (Source: CT DMV, July 2005):



Scope of School Bus Clean Up

Under a business-as-usual scenario, assuming that the age of the Connecticut school bus fleet remains constant, by 2010, approximately 1,924 buses will have been replaced by MY2007 or newer engines. Approximately 5106 buses will remain in the fleet with pre-2007 emission standards. Of that number, approximately 1100 are Type 2 (half-size) buses. These smaller buses are not addressed directly in this options menu. If past trends hold true, by 2010, an estimated 4000 Type 1 buses will require active clean up.

Current School Bus Registrations (Ariel Garcia, CTDEP)

<b>Model Year</b>	<b>Quantity</b>
2006	47
2005	306
2004	410
2003	426
2002	735
2001	621
2000	719
1999	656
1998	515
1997	537
1996	439
1995	719
1994	183
1993	321
1992	132
1991	127
1990	64
1989	22
1988	21
1987	22
1986	2
1985	3
1984	3

### **Option #1: New York City School Bus Law**

One option for Connecticut would be to adopt a program similar to New York City's. The key elements of this option are summarized below. The full text of the law is available at [http://www.nyccouncil.info/pdf\\_files/bills/law05042.pdf](http://www.nyccouncil.info/pdf_files/bills/law05042.pdf)

#### Summary

NYC Local Law No. 428-A requires the use of ultra low sulfur diesel fuel and best available retrofit technology for all pre-2007 school buses.

#### Timing – ULSD

- (1) Beginning July 1, 2006, any diesel fuel-powered school bus that is operated by a person who fuels such school bus at any facility at which **ultra low sulfur diesel fuel** is available, or of which such person has the exclusive use and control, or at which such person has the ability to specify the fuel to be made available, shall be powered by ultra low sulfur diesel fuel;
- (2) Beginning September 1, 2006, any diesel fuel-powered school bus to which paragraph one of this subdivision does not apply shall be powered by ultra low sulfur diesel fuel.

#### Timing – BART

Diesel fuel-powered school buses shall utilize the best available retrofit technology in accordance with the following schedule:

- i. 50% of school buses used to fulfill each school bus contract by September 1, 2006;
- ii. 100% of school buses used to fulfill each school bus contract by September 1, 2007.

#### BART Definition

“Best available retrofit technology” means technology, verified by the United States environmental protection agency or the California air resources board, for reducing the emission of pollutants that achieves reductions in particulate matter emissions at the highest classification level for diesel emission control strategies, as set forth in **subdivision e** of this section, that is applicable to the particular engine and application. Such technology shall also, at a reasonable cost, achieve the greatest reduction in emissions of nitrogen oxides at such particulate matter reduction level and shall in no event result in a net increase in the emissions of either particulate matter or nitrogen oxides.

#### BART Determinations

The commissioner shall make determinations, and shall publish a list containing such determinations, as to the best available retrofit technology to be used for each type of diesel fuel-powered school bus to which this section applies. Each such determination shall be reviewed and revised, as needed, on a regular basis, but in no event less often than once every six months.

#### Subdivision E: BART Classifications

The classification levels for diesel emission control strategies are as follows, with Level 4 being the highest classification level:

- i. Level 4 – reduces tailpipe diesel particulate matter emissions by 85 percent or greater or reduces engine emissions to less than or equal to 0.01 g/bhp-hr;
- ii. Level 3 – reduces tailpipe diesel particulate matter emissions by between 50 and 84%;
- iii. Level 2 – reduces tailpipe diesel particulate matter emissions by between 25 and 49%;
- iv. Level 1 – reduces tailpipe diesel particulate matter emissions by between 20 and 24%.

**Option #2: Significant emission reductions for all CT school buses, and preventing crankcase emissions from entering the cabins of school buses.**

This option would assure that all Connecticut school buses will be cleaned up with at least DOCs and closed crankcase ventilation systems, but avoids triggering a "BACT" review.

Summary

- By no later than September 1, 2010, 100% of Type 1 school buses serving a Connecticut school district must:
  1. Have an engine model year of 2007 or newer; OR
  2. Be retrofit with a CARB/EPA-verified emissions control device certified to reduce PM emissions by at least 25% and a closed crank-case ventilation system; OR
  3. Use an alternative fuel that achieves equivalent or greater PM benefits to option (1) above, or use in combination with options (1) or (2) above.
- By no later than September 1, 2010, all school buses that transport children in Connecticut may be no more than X years old. Unless extended, this provision could sunset in 20XX (when all CT school buses would, under this approach, meet 2007 emission standards).

Minimum Compliance Scenario

This scenario assumes that of approximately 5500 Type 1 buses in Connecticut:

- Approximately 1200 will have turned over to MY2007 or newer engines by 2010 through business-as-usual turnover schedule;
- 4300 will have to be actively cleaned up. This is a conservative estimate, including a 300 bus cushion beyond expectations from past trends to account for potential variation due to the anticipated additional cost of buses meeting MY2007 emission requirements, (see Introduction).

Alternative routes to compliance (with additional emission reduction benefits) include early replacement of school buses with MY2007 or newer engines, or retrofitting engines with more sophisticated tailpipe emission control equipment such as a catalyzed wire mesh filter or a diesel particulate filter.

**Minimum compliance cost/benefit scenario**

Diesel oxidation catalysts + closed-crankcase filters on all 4300 buses

Cost<sup>2</sup> = \$1,200 per bus \* 4300 buses = \$5,160,000

Benefit = 35% tailpipe PM reductions

Annual Avoided Emissions<sup>3</sup> = 5 tons tailpipe + near total elimination of crankcase emissions (in-cabin PM2.5)

Reporting and Compliance

Under current law, school buses have to register annually with the Connecticut Department of Motor Vehicles, and prior to each school year, each bus must undergo a mandatory safety inspection. The state could amend the reporting requirements associated with this option to the

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<sup>2</sup> Cost of DOC + Spiracle Kit for 2004 New Haven School Bus Retrofit Project, (Source: Tracy Babbidge, CTDEP)

<sup>3</sup> Calculated using emission rates in NESCAUM analysis of projected emission reductions for 2004 New Haven School Bus Retrofit Project

existing registration requirements. School districts would provide the DMV with documentation of compliance (including engine model, model year, and type of retrofit, date installed, etc.) as a supplemental to the currently-required registration paperwork. Furthermore, the mandatory annual safety inspection would be supplemented by an emissions compliance inspection.

#### Enforcement

The policy should provide for some form of enforcement provision to compel districts and school bus owners/operators to comply in a timely manner. One example that Connecticut could consider is New York City law which imposes civil penalties on school bus operators or owners who violate the requirements. In New York, owner/operators are liable for a civil penalty between \$1,000 and \$10,000 in addition to twice the amount of money saved by their failure to comply. An additional civil penalty of \$20,000 must be paid in the event that an owner or operator has made a false claim.

### **Option #2.1: Priority Communities Provision**

This option is proposed as a supplementary component to Option #2, and would provide additional protection for children in higher risk communities.

#### Summary

- Implement “Best Available Emissions Control” in priority communities, where children are already at risk from elevated levels of PM<sub>2.5</sub>, as determined by the CT DEP.

#### Creating incentives for Best Available Emission Control (BAEC)

“Best Available Emissions Control” for school buses results in closed crankcase ventilation and a tailpipe particulate matter emissions rate of 0.01 g/bhp-hr, the original engine manufacturer (OEM) emissions standard for all new, on-road, heavy-duty diesel engines beginning with MY2007. Retrofitting pre-2007 school bus engines with diesel particulate filters and closed crankcase ventilation systems also results in this standard being met. Using an alternative fuel such as natural gas could also achieve this standard.

#### Justification

Some Connecticut communities have high levels of ambient air pollution and high incidence of childhood respiratory impacts. For these communities, a higher standard of school bus emission control can be justified. Under this option, a supplemental incentive program would be established to cover some or all of the incremental costs of achieving BAEC in school districts of designated “Priority Communities.” This additional incentive would provide support to school districts in priority communities for procuring buses with MY2007 or newer engines, or purchasing/installing diesel particulate filters with closed crankcase ventilation systems. Compared to a minimum compliance scenario (35% PM reductions), BAEC would yield at least 85% PM reductions. These additional benefits would accrue directly to children in overburdened communities, who are particularly vulnerable to the harmful effects of diesel particulate matter.

#### Implementation

To implement this option, model contract language for procuring BAEC buses should be designed by DEP and the Department of Administrative Services (DAS). DEP and DAS staff should provide outreach and assistance to designated priority communities so that each is prepared to submit an alternate bid for BAEC buses, in addition to a business-as-usual bid. The increment of cost between the regular bid price and the BAEC bid price could be reimbursed in part or in full through a state incentive program. The school districts should be responsible for providing documentation of school bus procurement, including the business-as-usual bid price and the BAEC price. For school districts that own their own school buses, a model bid specification for purchasing MY2007-compliant buses or BAEC retrofits should be developed and disseminated. Documentation of bid price should be provided to DEP. Provisions for preventing price inflation should be established.

#### Identification of “Priority Communities”

The Department of Environmental Protection should be responsible for identifying “Priority Communities.” In its proposal for school bus retrofit funding from the VEPCO settlement in 2003, the CTDEP utilized statewide air-monitoring data to prioritize school districts based on the



overall quality of local air. From CTDEP's 2003 VEPCO plan (<http://www.dep.state.ct.us/air2/diesel/docs/vep.pdf>):

“While the emission reduction goals from diesel school bus retrofit projects are focused on reducing the localized exposure risks of school children being transported by school buses, the health of children may already be at risk in areas that have elevated levels of particulate matter and ozone pollution. In certain areas of the State, the existing regional air quality can present respiratory and other health problems for children. Priority has been given to districts that are located in areas that face the most serious regional air pollution concerns and would benefit from diesel reduction strategies.”

The following Connecticut communities are highlighted in the DEP's plan because they have 3-year annual average particulate concentrations of greater<sup>4</sup> than 12 ug/m<sup>3</sup>: Bridgeport, Danbury, Hartford, New Haven, Norwalk, Stamford, Waterbury, Westport. Connecticut's urban areas are disproportionately overburdened by a variety of sources of environmental pollution. Residents tend, on the whole, to suffer disproportionate health impacts associated with pollution (such as asthma). The VEPCO plan also cites methods for prioritizing communities through an environmental justice screen, including identifying “distressed cities” as designated by the DEP's Environmental Equity Program, and “high need urban area” as designated by the Department of Education.

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<sup>4</sup> 12 ug/m<sup>3</sup> is the level to which EPA staff scientists have recommended lowering the federal annual standard for PM2.5 to adequately protect public health. The State of California adopted this standard in 2002 based on extensive review of health-based scientific literature.

### **Option #3: Average fleet-age requirement with alternative compliance through emissions reductions**

This option outlines an approach that would provide flexibility to school bus owners & operators, while achieving significant emission reductions.

#### Summary

- By no later than 2010, the average engine age of each school bus fleet in Connecticut would not exceed 4 years;
- The alternative compliance provision would permit subject fleets to install emission control retrofits in lieu of retiring older buses;
- A backstop engine age limit of X years would be instituted.

#### Policy Option Elements

(a) Phase-out of oldest bus engines. Under this option, beginning January 1, 2006, no public school district in Connecticut could enter into a contract for any Type 1 bus with an engine model year older than X years. Beginning September 1, 2010, no public school district shall transport school children in any Type 1 school bus with an engine model year older than X years.

(b) Mitigate crank-case emissions. In order to minimize seepage of emissions into the cabin, all buses must have closed crankcase ventilation systems installed. The terms of this subsection would apply to all public school buses operated in Connecticut by September 1, 2008.

(c) Phase-in of younger buses. Beginning September 1, 2006, no public school district in Connecticut could contract for a school bus fleet with an average engine emissions age for full-sized school buses of greater than four years. By September 1, 2010, the average engine emissions age for full-sized school bus fleets operated or contracted by public school districts in Connecticut, based on engine model year, could be no greater than four years old. Buses with an engine model year that is the same year in which a calculation is being made could be counted as zero years old. Buses of MY 2007 or later could be counted as zero years old. The engine emissions age for all other buses would be counted in whole numbers by subtracting the model year of the bus engine from year in which the calculation is being made.

#### (d) Alternative compliance.

- a. A bus engine retrofit with an emission control device or using an alternative fuel verified by CARB/EPA to achieve Level 3 PM reductions ( $\geq 85\%$ ) shall be counted as zero years old;
- b. A bus engine retrofit with an emission control device or using an alternative fuel verified by CARB/EPA to achieve Level 2 PM reductions ( $\geq 50\%$ ) shall be counted as two years old;
- c. A bus engine retrofit with an emission control device or using an alternative fuel verified by CARB/EPA to achieve Level 1 PM reductions ( $\geq 25\%$ ) shall be counted as four years old;

#### (e) Reporting and Conditions of Registration.

- (1) The Department of Motor Vehicles would establish reporting forms and procedures for public school districts of Connecticut to record their annual

progress in complying with the provisions of this section, including information regarding the model year, crank case emissions mitigation system, or alternative compliance system relevant to each Type 1 bus. Reports would be submitted to the Department of Motor Vehicles with the Student Transportation Vehicle Inspection Report no later than August 31 of each year. The Department of Motor Vehicles would also provide an annual report to the Department of Environmental Protection no later than December 31, 2006 and each December 31 thereafter on progress in reducing emissions from public school buses until there are no longer any Type 1 school buses older than model year 2007 operating in the state or in the year 20XX, whichever comes first.

- (2) The Department of Motor Vehicles would not re-register any in-use Type 1 school bus that:
  - A. is not accounted for in a school district's progress report, or
  - B. is part of a school bus fleet that has failed to demonstrate full compliance with any provision of this section.
- (3) Any inconsistencies found during an inspection between actual state of the vehicle and the information contained in the annual progress report regarding the model year, crank case emission mitigation system, or alternative compliance system shall constitute an infraction and prohibit the issuance of an inspection sticker.

(f) Sunset. The requirements of sub-sections (c) and (d) of this section would expire when there are no longer any Type 1 school buses older than model year 2007 operating in the state or in the year 20XX, whichever comes first.