CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD

STAFF REPORT:

PROPOSED 2005-2006 LOWER-EMISSION SCHOOL BUS PROGRAM GUIDELINES AND FUNDING ALLOCATION

Date of Release: January 24, 2006
Scheduled for Consideration: February 23, 2006

Table of Contents

List of Appendices

List of Tables

Executive Summary

The mission of the Air Resources Board (ARB or Board) is to provide clean healthful air to California's residents, and to protect those most vulnerable to the harmful effects of air pollution. To aid in this mission, the State Legislature appropriated and Governor Schwarzenegger approved $25 million in the 2005-2006 fiscal year (FY) State budget for the Lower-Emission School Bus Program – a program designed to reduce school children's exposure to both cancer-causing and smog-forming pollution.

Exhaustive studies have shown that children are more susceptive to the health effects of air pollutants due to the lung development occurring and that children can experience on-board bus exposures higher than expected. Therefore ARB is particularly concerned about the exposure of children to diesel related pollutants during school bus commutes. The primary goal of the Lower-Emission School Bus Program is to reduce school children's exposure to both toxic PM emissions and smog-forming oxides of nitrogen (NOx) through two program components: 1) new school bus purchase to replace the oldest, highest-polluting buses with new, lower-emitting buses meeting the latest federal motor vehicle safety standards; and 2) retrofitting in-use diesel school buses to significantly reduce PM emissions. The $25 million in State funds for the 2005-2006 FY will replace about 90 of California's oldest school buses and retrofit nearly 1,000 in-use diesel school buses.

During the first four years of the Lower-Emission School Bus Program, about 500 pre-1987 school buses have been replaced and about 3,000 in-use diesel buses have been retrofitted using State funds which have been distributed on a per capita basis. The demand for replacement school buses has far exceeded availability, especially for replacement of pre-1977 buses which do not meet federal safety standards. The demand for retrofit funds has been somewhat limited, in part due to the need to fuel with ultra-low sulfur diesel (ULSD) fuel. However, retrofits are the most cost-effective use of the school bus funding in order to reduce children's exposure to toxic PM. They provide at least an 85 percent reduction in emissions at a cost of about 10 percent of a new bus. In addition, starting in September 2006, the ULSD fuel required for some retrofit technology will become the standard diesel fuel across California, eliminating one concern related to retrofits in the past.

Staff is proposing to modify the allocation methodology used for the disbursement of the 2005-2006 FY State budget funding for school bus replacement. A contingent of 27 legislators has requested that these replacement funds be disbursed to replace the oldest school buses in California first. This request came in a letter, included below, from a diverse group of legislators representing a cross section of regional and political interests. Allocation by oldest bus first will help those regions with a significant number of older buses to "catch-up" to other regions that have been able to replace their oldest buses more frequently. Moving forward, most districts will have some ability to replace their oldest buses more regularly through a new source

of funding available to districts with the adoption of an additional $2 motor vehicle registration surcharge.

The Lower-Emission School Bus Program Guidelines (Guidelines) have been completely revised as a new document. It is included as Appendix A of this staff report. The staff report discusses the policy analysis which supports the Guidelines.

The Guidelines document includes new provisions to cover funding expenditure requirements specific to the 2005-2006 FY State budget funds as well as modifications generally applicable to all funds to be spent pursuant to the Guidelines. One new source of funding available to air districts for new school bus purchase is provided by Assembly Bill 923 (AB 923: Statutes of 2004, Chapter 707). This legislation provides a mechanism for air districts to increase the motor vehicle registration surcharge by an additional two dollars which may be used for the new purchase of school buses pursuant to the Lower-Emission School Bus Program.

The proposed changes to the Guidelines specific to 2005-2006 FY State funding are summarized below.

- Replacement of pre-1977 buses exclusively
- Replacement of buses in the order of oldest bus replaced first
- Retrofit funding exclusively for devices obtaining the highest percent reductions (referred to as Level 3), with a priority on funding devices that produce the lowest NO_2 emissions across the device
- New program timetable

The modifications applicable to all funds pursuant to the Guidelines, including the State budget funds as well as other funding, such as AB 923, are:

- Waive required school district match for new bus funding
- Eliminate, as a goal or requirement, that a specified percentage of the replacement buses must be alternative-fueled, subject to local air district rules
- Add requirement for CHP inspection after retrofit and prior to return to service
- Allow funding for required maintenance of diesel particulate filters
- Allow funding for data logging of each bus to be retrofit
- Add provision for use of certain local air district funds to be used for fuel tank replacement for in-use compressed natural gas-fueled buses

The letter directing ARB to replace California's oldest buses first is provided below:

CALIFORNIA LEGISLATURE

STATE CAPITOL
SACRAMENTO, CALIFORNIA
95814

October 11, 2005

Barbara Riordan, Acting Chair
State Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Clean School Bus Funding Allocation Plan

Dear Ms. Riordan:

As you know, this year's budget includes $12.5 million for the replacement of school buses manufactured before 1977. According to the allocation plan laid out in a memo from Air Resources Board (ARB) staff to Secretary Lloyd dated September 21, 2005, school districts may not be able to apply for these funds until September 2006. With this schedule, two school years may pass before our children are able to benefit from these funds.

According to discussions with your staff, it is our understanding that the ARB is now revising this schedule so that funds will be distributed by June 2006 or earlier. We would appreciate a copy of this updated allocation schedule.

We have been told that, because the budget language specifies a different allocation method than the per-capita basis used in the past, the ARB feels it is necessary to hold public workshops and gather other comments on the alternative allocation scheme. Prior to any workshops, we would like to clarify the legislative intent of the budget language in order to expedite the allocation process.

The budget language of §3900-0001-0044 (Motor Vehicle Account) specifies that $12.5 million is to be allocated for the ARB to "replace pre-1977 school buses with new school buses that comply with the most recent passenger safety standards." Because these funds are not sufficient

to replace all of the pre-1977 buses in California, we are asking the ARB to allocate funds to replace the oldest of the pre-1977 buses first based upon manufacture date.

If a second factor is needed to prioritize funding between buses with the same manufacture date, we feel it is appropriate for the ARB to use the bus' total mileage, although this was not included specifically in the budget language.

While we would like to replace all pre-1977 buses, removing the oldest offending buses first will maximize both the air quality and safety benefits achievable. This distribution method will also ensure that the reduced risks to children's health from diesel emissions have an equitable geographic distribution.

We encourage the ARB to expedite the distribution of these important funds.

Sincerely,

Senator Pro-Tem Don Perata
Ninth District

Senator Dean Florez
Sixteenth District

Senator Charles Poochigian
Fourteenth District

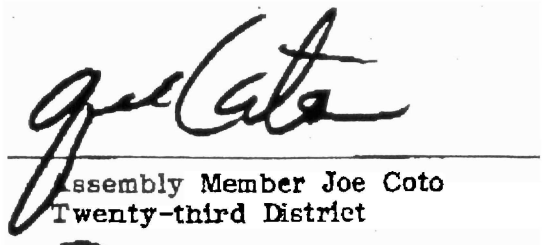
Assembly Member Michael Villines
Twenty-ninth District

Senator Jim Battin
Thirty-seventh District

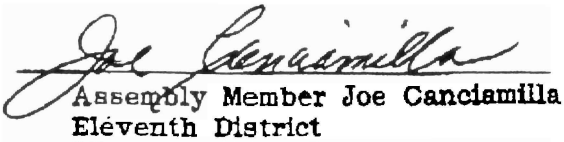
Assembly Member Greg Aghazarian
Twenty-sixth District

Senator Denise Ducheny
Fortieth District

Assembly Member Joe Baca
Sixty-second District

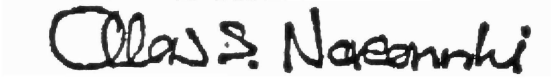


Assembly Member Joe Coto
Twenty-third District

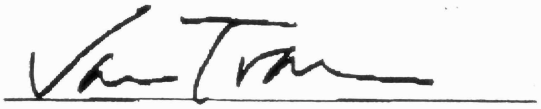


Assembly Member Joe Canciamilla
Eleventh District

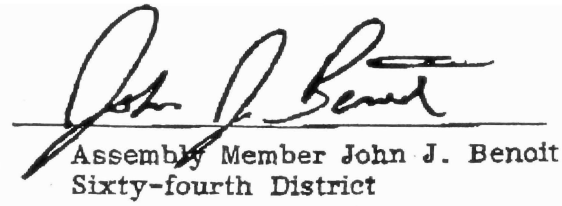
Senator Martha Escutia
Thirtieth District



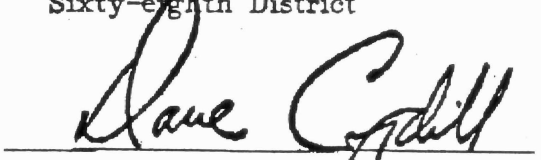
Assembly Member Alan Nakanishi
Tenth District



Assembly Member Van Tran
Sixty-eighth District

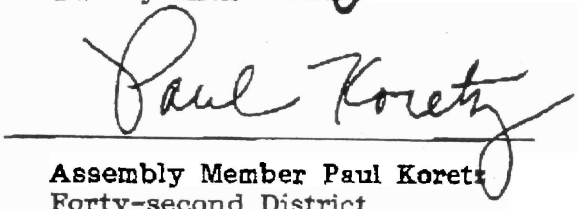


Assembly Member John J. Benoit
Sixty-fourth District

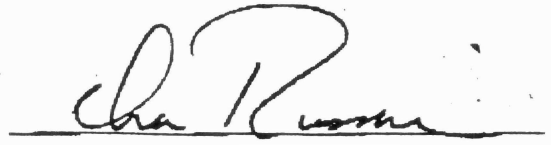


Assembly Member David Cogdill
Twenty-fifth District

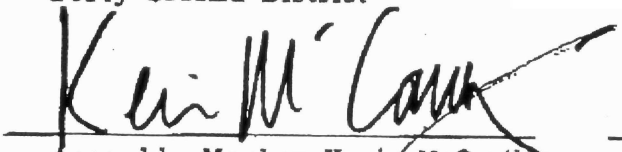
Senator Tom Torlakson
Seventh District



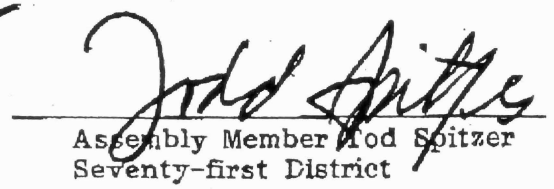
Assembly Member Paul Koretz
Forty-second District



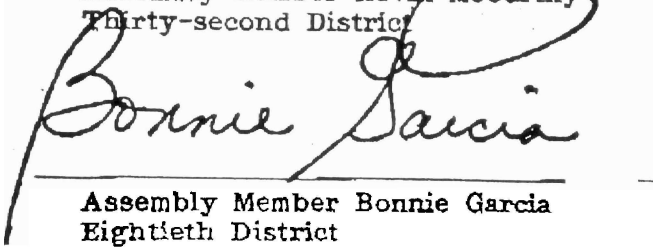
Assembly Member Ira Ruskin
Twenty-first District



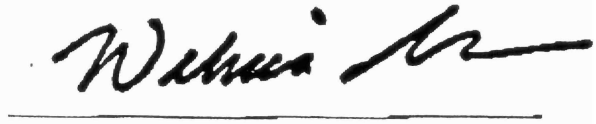
Assembly Member Kevin McCarthy
Thirty-second District



Assembly Member Todd Spitzer
Seventy-first District



Assembly Member Bonnie Garcia
Eightieth District



Assembly Member Wilma Chan
Sixteenth District

Assembly Member Roy Ashburn
Eighteenth District

Assembly Member Betty Karnette
Twenty-seventh District

Assembly Member Rebecca Cohn
Twenty-fourth District

Senator Wesley Chesbro
Second District

Assembly Member Fran Pavley
Forty-first District

cc: Governor Arnold Schwarzenegger
Secretary Alan Lloyd

I. INTRODUCTION AND SUMMARY

A. Introduction

The Legislature appropriated and Governor Schwarzenegger approved $25 million in the 2005-2006 fiscal year (FY) budget to the California Air Resources Board (ARB or Board) for cleaner, safer school buses. The Legislature specified in the budget language that these funds are to be used to reduce the risk to children's health from diesel emissions from school buses. Half of the funded amount, $12.5 million, shall be used to replace pre-1977 model year (MY) school buses with new school buses that comply with the most recent federal motor vehicle safety standards and that have been certified by the ARB to meet the lowest achievable emission levels irrespective of the fuel stock. The other half of the funds shall be used to retrofit in-use diesel school buses to protect children's health and reduce particulate matter (PM) emissions from those buses by at least 85 percent. ARB was directed by the Legislature to provide equitable geographic distribution of the funds in a manner that reduces the risk to children's health from diesel emissions from school buses.

The proposed 2006 Lower-Emission School Bus Program Guidelines (Guidelines), Appendix A, have been developed to provide guidance for the expenditure of these State funds as well as for other funding sources. Guidance for both the bus replacement (Lower-Emission School Bus Replacement Program) and retrofit (School Bus Retrofit Program) components of this program are contained in the Guidelines document. Assembly Bill 923 funds (AB 923: Statutes of 2004, Chapter 707) allocated to the purchase of new school buses are subject to the Guidelines. Air districts may also choose to apply these guidelines for the expenditure of other local funds.

Though the California Energy Commission (CEC) administers the Lower-Emission School Bus Replacement Program, the largest local air districts may seek authorization from CEC and ARB to administer their own programs. The School Bus Retrofit Program will be administered by air districts that choose to participate. Air districts and CEC will notify school districts of opportunities to participate in the programs. ARB will monitor the ongoing implementation of both program components and assist where needed.

It is a statewide priority to reduce the harmful emissions from older buses as expeditiously as possible. A demanding schedule for implementation, as shown on the timetables in Table 1 and Table 2, has been set. ARB, CEC, and the air districts are committed to the prompt successful implementation of this program.

B. Summary of the Program

As exhaustive studies have shown that children are more susceptive to the health effects of air pollutants due to the lung development occurring, ARB is particularly concerned about the exposure of children to diesel related pollutants during school bus commutes. The primary goal of the Lower-Emission School Bus Program is to

reduce school children's exposure to both toxic PM emissions and smog-forming oxides of nitrogen (NOx) through two program components: 1) new school bus purchase and 2) retrofitting in-use diesel school buses. Together these two components will enable the replacement of the oldest, highest-polluting buses with new, lower-emitting buses meeting the latest federal motor vehicle safety standards and significantly reduce PM emissions from existing buses.

About 500 pre-1987 school buses have been replaced and about 3,000 in-use diesel buses have been retrofitted during the first four years of the program using State funds. The program received about $76 million during these first four years of the program, $66 million allocated through the State budget process the first two years and $9.52 million through Proposition 40 funding the second two years. Proposition 40 was the voter-approved initiative to conserve natural resources and improve state and local parks. All of the Proposition 40 funds were directed towards new bus purchase. Overall, nearly $60 million was allocated to replacement of pre-1987 buses and $16.5 to retrofit in-use diesel school buses.

In 1977, the Federal Motor Vehicle Safety Standards went into effect. These standards require school buses to be equipped with seats that provide crash protection as well as other safety related equipment. Based on data provided through the California Highway Patrol (CHP) school bus safety certification program, staff estimates that there are about 300 school buses manufactured before 1977 currently in use in public school bus fleets. Additionally, these buses were not subject to NOx and PM emission standards and thus are high-emitting. Replacing these buses will result in reduced risk to children's health and safety. The State budget appropriation for new school bus purchase for the 2005-2006 FY is specifically designated for the replacement of pre-1977 school buses. The $25 million in State funds for the 2005-2006 FY will replace approximately 90 pre-1977 school buses and retrofit nearly 1,000 in-use diesel buses. The timetables for allocation of these funds are given in Table 1 and Table 2 below.

Table 1 Lower-Emission School Bus Replacement Program Timetable

February 23, 2006	Board acts on allocation plan and guidelines
March – June 2006	Funding Agreements to local air districts and CEC
August 1, 2007	New buses delivered and infrastructure completed
December 31, 2007	Final reports due to ARB

Table 2 Lower-Emission School Bus Retrofit Program Timetable	
October 27, 2005	Retrofit grant agreements to larger air districts for 90% of retrofit funds
February 23, 2006	Board acts on allocation plan and guidelines
March 31, 2006	Smaller air districts apply to ARB to participate
May - June, 2006	Remainder of grant agreements finalized
June 30, 2007	Air districts obligate all retrofit funds
September 30, 2008	Final reports to ARB on use of funds

The new proposed Guidelines document (Appendix A) is intended as a stand alone document to provide guidance for spending funds on new school buses or on retrofits for school buses. If approved, the document will replace previously issued Guidelines and addendums. The sources of funding include the 2005-2006 FY State budget funds, AB 923 funds, and other local funds per the air districts' discretion. The proposed changes are summarized in the Executive Summary.

II. NEED FOR THE PROGRAM

A. Background

Data provided through the CHP school bus safety certification program indicate that there are currently about 300 public school buses in use that were manufactured before 1977, as shown in Table 3 below. These buses were manufactured before either Federal Motor Vehicle Safety Standards or any emission standards went into effect. As shown in the table, there are on the order of 3,000 to 4,000 school buses manufactured between 1977 and 1986 in public school fleets. These buses conformed to the Federal Motor Vehicle Safety Standards and were controlled for NOx, but had no PM controls. The remainder of the fleet was manufactured in 1987 or later and was subject to both NOx and PM emission standards as well as the safety standards.

Table 3 California's Public School Bus Fleet				
Model Year	**Approx. # of Buses**	**Safety Standard**	**NOx Standard**	**PM Standard**
Pre-1977	~ 300	NO	NO	NO
1977-1986	3,000 - 4,000	YES	YES	NO
1987- 2005	~12,000	YES	YES	YES
Total	16,000			

The average school bus travels about 14,000 miles per year, according to ARB's On-Road Mobile Source Emission Inventory Model EMFAC2002 (version 2.2 April 23, 2003). This low annual mileage is part of the reason that school buses remain on the road much longer than most other heavy duty vehicles. Limited transportation budgets to replace older buses are also a factor. Additionally,

the low annual mileage reduces the cost effectiveness of replacing these buses which makes them poor candidates for Carl Moyer funding.

B. School Buses in California

There are nearly 27,000 school buses in California. California Department of Education (CDE) survey data indicates that approximately 16,000 of the buses are owned by public schools. The remainder of the school bus fleet is privately owned. A small fraction is owned by private schools while the rest are owned by private contractors providing service for public schools.

In California, per Title 13 California Code of Regulations section 1201(b) paragraphs 1 and 2, school buses are designated either as Type 1 (seating capacity is 16 or more) or Type 2 (Seating capacity is no more than 20 occupants, and the bus is under a 10,000 pound gross vehicle weigh rating). Fuels used in school buses are primarily gasoline, diesel, and compressed natural gas (CNG). Diesel is by far the most common fuel used today in school buses, at approximately 80 percent of all California school buses. Gasoline is only commonly used in the smaller Type 2 buses. To date, CNG buses have primarily been funded through state and local incentive programs, such as the CEC's Safe School Bus Clean Fuel Efficiency Demonstration Program, the Lower-Emission School Bus Program, and local air district programs. Currently there are about 800-900 alternative-fueled buses in California's school bus fleet. The estimated emissions for year 2005 from all school buses are approximately 14 tons per day of NOx and about 0.5 tons per day of PM.

C. 1977 Federal Motor Vehicle Safety Standards – Need for safer buses

In 1977, the federal government established safety requirements for new school buses.[1,2] No consistent safety requirements were in place for buses produced prior to April 1,1977. Therefore, replacement of these oldest buses has been a priority. Among the requirements that the new safety standards specify are:

- Special passenger crash protection equipment
- Better brakes
- Emergency exits
- Swing out stop arms, warning lights and special mirrors
- Rollover protection and fuel system protection.

D. Children's Health Risk

Health studies have demonstrated that children are more susceptive to adverse health effects from air pollution.[3] In 2003, ARB sponsored a study conducted by University of California Riverside and Los Angeles campuses to assess effects of children's exposure to diesel exhaust pollutants during their commutes in school buses.[4] The study measured pollutant concentration inside the bus over an actual school bus route in Los Angeles. For comparison, a diesel-fueled bus equipped with a diesel particulate filter (DPF) and a CNG-fueled bus were also included. The results from the study were:

- Bus stop and bus loading/unloading activities have a very small effect on exposure due to low concentrations and the short time involved
- Self-pollution from the bus's own exhaust has a significant impact especially when the windows are closed.
- Cleaner buses also have lower in-vehicle exposure. Both the CNG-fueled bus and the DPF equipped diesel-fueled bus show significantly reduced on-board concentrations of pollutants as compared to conventional diesel buses.
- Older buses (pre-1987) have higher emissions than the newer buses and present a greater health risk to the children during the commute.
- Other traffic exhaust emissions also add to exposure risk, with the risk being higher on the primary urban route as compared to the suburban or rural route.

Increased exposures from commuting by school bus are estimated to increase a child's lifetime cancer risk due to diesel PM by approximately 4 percent or an increase of 30 per million lifetime risk. An increased risk of lower respiratory symptoms (~ 6 percent) and daily hospitalizations for asthma (~ 1 percent) are also estimated.[5] Despite the increase in exposure to diesel related pollutants, commuting by school bus is still the safest way for children to travel to school when overall mortality rates are considered.[6]

An additional study of traffic related emissions supported by ARB is the Children's Health Study, which began in 1992.[7] This is a large, long-term, study of the effects of chronic air pollution exposures on the health of children living in Southern California. This study has shown that local exposure to outdoor nitrogen dioxide (NO_2) or other freeway-related pollutants has adverse effects on the respiratory health of children. NO_2 can be a by product of catalyzed diesel particulate filters. The ARB is in the process of developing NO_2 limits to be included in verification requirements.

E. Need for Funding

Approximately 4,000 of California's current school buses were manufactured prior to the institution of PM emission standards. Staff estimates that about 300 of these buses serving public schools were manufactured before the 1977 model year when federal safety standards and NOx emission standards went into effect. To date, most older buses have remained in service due to the lack of school district funding to replace them.

About 800 school districts in California operate their own buses. Some of these school districts contract with private transportation providers. Funding for school transportation services typically comes from the respective school district's general funds. Currently, there are insufficient special state or local funding sources designated for this non-mandated service. School transportation must compete for both capital and operating funds with mandated school district responsibilities as well as funding to support classroom needs. School transportation officials address these funding issues in various ways. Many school districts have increased the

distance criteria for providing home to school transportation services to students so that fewer buses are needed. As general home to school transportation is not State-mandated, some school districts do not provide transportation themselves but rely on public transportation or parent-provided transportation. To avoid the capital expenditure of purchasing new school buses, a common choice school districts elect is to maintain existing buses as long as possible. The subsequent result is an aging fleet of buses. Due to the low annual mileage of school buses, these buses continue to operate reliably and have relatively few maintenance issues. However, these older buses are not nearly as safe as current buses and emit very high emissions.

The following briefly summarizes other sources of funding for California bus replacement besides the Lower-Emission School Bus Program.

1) Assembly Bill 923 Funds

A new source of funding for clean air projects became available to air districts in 2005. Through the passage of AB 923 in September 2004, air districts were authorized to increase the motor vehicle registration surcharge from four to six dollars. The additional two dollar surcharge provides up to $55 million annually and may be used for a number of clean air projects, including the new purchase of school buses pursuant to the Lower-Emission School Bus Program.

In order for an air district to institute this surcharge, the governing board of the air district must adopt and approve a resolution providing for the fee increase and a corresponding program for the expenditure of the resulting funds. To date, fourteen of the thirty-five air districts have adopted this surcharge, including most of the large districts.

2) Small School Districts/California Department of Education

The Small School District Bus Replacement Program, administered by the California Department of Education, was initiated in the 1983-1984 fiscal year. The program is open to any school district or county office of education with an average daily attendance of less than 2,501. Funding for this program is based on three priorities; replacement, reconditioning, or fleet expansion of school buses that do not conform to Federal Motor Vehicle Safety Standards. Current fiscal year funding is about $4.9 million. Historically, funding has allowed for the replacement of approximately 45 to 50 new buses each year. New guidelines for the program are currently being developed.

3) Assembly Bill 2766 Funds

Revenues collected from the first four dollars of the motor vehicle registration surcharge, authorized by the passage of Assembly Bill 2766 (AB 2766: Statutes of 1990, Chapter 1705), may be used to fund the replacement of on-board fuel tanks in CNG-fueled school buses. The Department of Transportation requires, per title 49 Code of Federal Regulations (CFR) Part 571.304, that these tanks be visually

inspected every three years or 36,000 miles and not used after the end of manufacturer's recommended service life, typically 15 years.

4) Local Air District Grant Programs

A few school districts have secured air quality incentive funds from local air districts through competitive programs, such as those funded through a fee on motor vehicle registrations. In these cases, the air districts co-fund the cost of low-emitting alternative fuel buses and fuel infrastructure. Air districts have also funded a few electric school bus projects. However, most air quality incentive program funds, including the ARB's own Carl Moyer Program, offer only incremental funding, e.g., the difference in cost between a new conventional diesel bus and a new alternative fuel bus. This is not adequate co-funding for most school districts. Also, school bus replacement projects are less competitive than other heavy-duty vehicle projects because school buses travel fewer miles per day and overall emit less than other heavy vehicles that are used more; thus school bus projects may not meet certain program criteria, such as overall cost effectiveness. Within the Carl Moyer Program, a new program referred to as fleet modernization provides funding for the scrappage and replacement of an old heavy-duty vehicle with a new heavy-duty vehicle. ARB is currently evaluating the expansion of this program to school buses.

5) Additional Programs

Two additional funding programs that have been utilized are the United States Environmental Protection Agency's (U.S. EPA) Clean School Bus USA program and the Katz Safe School Bus Clean Fuel Efficiency Demonstration Program. The Clean School Bus USA program is a modest cost-shared grant program that funds bus purchases, retrofits, and other emission control strategies. This program was funded at $5 million nationally for each of the 2003 and 2004 fiscal years, $7.5 million for the 2005 fiscal year, and has a proposed budget of $10 million for 2006. One California project was funded in 2003 which included the retrofitting of 62 buses. Two California projects were funded in 2004, involving both retrofits and the replacement of seven pre-1987 diesel buses. This is a competitive program which receives about 120 grant requests per year totaling over $50 million. The program is able to fund only about 20 of the projects. The Katz program conducted by the CEC funded a total of 826 buses in the program's four main phases from 1988 to 1999. Approximately half of these buses were alternative-fueled. This program has concluded and no funds are available.

III. LOWER-EMISSIONS SCHOOL BUS REPLACEMENT PROGRAM

$12.5 million has been appropriated through the State budget process for new bus purchases to replace about 90 pre-1977 school buses for the 2005-2006 FY. The Governor requested an allocation plan for the bus replacement and the $12.5 million in retrofit funds. The allocation plan was submitted to the California Environmental Protection Agency (Cal/EPA) for approval on September 21, 2005 and is provided in Appendix C. The Cal/EPA response approving the plan is provided in Appendix D. On October 11, 2005, a letter from the Legislature was received that supplied further

clarification on the intent of the budget language. This letter, included in the Executive Summary above, requested that the funding be used to replace the oldest school buses in California and was signed by 27 legislators representing a wide cross-section of regional and political interests.

In past years, the Lower-Emission School Bus Program has provided funding for the replacement of pre-1987 school buses with the requirement that pre-1977 buses in a given district, if any, be replaced first. Additional incentive for replacing the oldest buses was also provided by requiring a smaller portion of the purchase price to be funded by the school district (match funding) for the replacement of pre-1977 buses than for the replacement of 1977 to 1986 buses. The funding appropriated from the State budget for the 2005-2006 FY specifically requires the replacement of pre-1977 buses due to safety concerns.

Past funds have been allocated to air districts according to their respective population size. The larger air districts have administered their own bus replacement programs in previous years and CEC has administered a program for the remainder of the air districts. The following paragraphs discuss the options considered for allocating the $12.5 million in new bus funds.

A. Funding Allocations for School Bus Replacements, 2005 – 2006 Funds

Historically, the funding allocation for the Lower Emission School Bus Program has been on a per capita basis. The budget language for the 2005-2006 fiscal year funding (Appendix B) stipulates that ARB provide equitable geographic distribution of the funds in a manner that reduces the risk to children's health from diesel emissions from school buses. While this language is not explicit in specifying the funding allocation, a legislative letter (included in the Executive Summary above) was provided to clarify the intent of the budget language. This letter requested that the new school bus purchase funding be allocated to replace the oldest school buses first. This letter was signed by 27 legislators representing a wide cross section of regional and political interests.

A workshop was held on October 14, 2005, to present different allocation options and to receive public comment. These options are discussed in Section V.A. Staff is proposing that the allocation method advocated by the legislative letter, replacing the oldest buses first, be approved.

Staff has revised the estimated cost per bus from $125,000, used at the October 14, 2005 workshop, to $140,000 to reflect a mix of CNG and diesel-fueled buses and to better represent the expected funded amount based on no match requirements, the addition of sales tax, and funding of some infrastructure. This means that the $12.5 million will probably replace about 90 buses.

1) Oldest Bus First Funding Allocation

As proposed, selected buses would be replaced, oldest first, until the funds are exhausted. A list of the oldest buses in California is given in Appendix F. There are

about 120 buses are on this list. We estimate that the available funding will replace about 90 buses on this list; therefore buses near the end of the list may not be replaced. This list of buses is from the CHP based on their 2004-2005 bus safety certification records. ARB staff conducted a phone survey of the operators of buses on this list to verify that the buses are still in service.

The buses range in model years from 1951 to 1973. The first 90 buses on the list are 1972 model year and older. The last 31 buses on the list are 1973 buses. Staff proposes that for the situation where only a portion of a group of identical MY buses can be replaced, the buses selected for replacement be chosen by lottery in order to release the funds in the most expeditious manner. Proposed new bus funding allocations are shown in Table 4 below for the larger air districts that will administer their own programs and for the CEC administered program, where only the districts with larger numbers of buses to be replaced are shown. For these allocations, it was assumed that the 90 buses that are 1972 and older are replaced. The funding amounts shown are based on an approximate cost of $140,000 per bus. This value should allow the funding of a mix of diesel-fueled and alternatively-fueled buses. If the funding allows for the replacement of more than 90 buses, the additional replaced buses will be chosen by lottery from the 1973 model year buses.

Table 4. Proposed New Bus Funding Allocation

Air District Administered Program	**Approx. Funding**	**Approx. # of New Buses**
San Joaquin Valley APCD	$4,340,000	31
South Coast AQMD	$2,100,000	15
Bay Area AQMD	$560,000	4
San Diego County APCD	$0	0
Sacramento Metropolitan AQMD	$0	0
Total Air District Administered Program	$7,000,000	50
CEC Administered Program		
Kern	$1,540,000	11
Ventura APCD	$980,000	7
Monterey Bay Unified APCD	$700,000	5
All Other Districts	$2,380,000	17
Total CEC Administered Program	$5,500,000	~40
Total	$12,500,000	~90

B. Eligible Buses

Buses eligible to be replaced under the Lower-Emission School Bus Guidelines are buses with Gross Vehicle Weigh Rating (GVWR) greater than 14,000 pounds owned by public school districts. To be eligible for replacement, buses must have a current CHP safety certification as of December 31, 2005, and at the time a school district is awarded funding to replace the bus (i.e., the school bus cannot have a lapsed CHP

safety certification), and must be currently registered with the Department of Motor Vehicles. Buses to be replaced with the 2005-2006 FY State budget funding must be pre-1977 buses. For funding not subject to the 2005-2006 FY budget language restraints, buses to be replaced must be pre-1987 model-year, with preference given to pre-1977 buses.

C. Alternative-fueled and Conventional-Fueled Bus Purchases

With the adoption of the Lower-Emission School Bus Program Guidelines in December 2000, the Board designated two-thirds of the new bus purchase funding for lower-emitting alternative-fueled school buses and one-third of the funding for lower-emitting diesel-fueled school buses. While originally the Board's intent was for this policy to be implemented on a regional basis, the reduced funding levels during the following years resulted in ARB maintaining the funding split as a statewide goal with less emphasis on region-specific implementation.

Making the alternative-fueled/diesel-fueled bus funding split a statewide goal provides guidance for the purchases while allowing air districts the flexibility to tailor their bus replacement programs to the needs specific to their region. This has allowed air districts with severe ozone nonattainment areas to concentrate their purchases on buses that provide NOx emission benefits while allowing diesel-fueled bus purchases in regions where the necessary alternative fuel refueling infrastructure is not available.

Although the previous allocation of two-thirds alternative fuel and one-third diesel has been effective in the past as both a requirement and a goal, it is not clear that a ratio is necessary or appropriate for the current allocation. Some of the oldest buses are in school districts located in areas without access to alternative fuel infrastructure. Others are in areas where citing issues limit their access to alternative fuel. In order to facilitate the replacement of California's oldest public school buses, staff recommends that these school districts be allowed to choose to replace their buses on the oldest bus list with either a diesel-fueled or alternative-fueled bus subject to local air district rules. However, staff also recommends that funding for alternative-fueled buses include up to an additional ten percent of the bus purchase price as funding for alternative fuel infrastructure when needed in order to obtain the greater emission benefits of alternative fuel.

The following paragraphs discuss the staff's proposed emission criteria for new bus purchases, the South Coast Air Quality Management District's (SCAQMD's) alternative-fuel rule and its possible impact on replacing the oldest buses, CNG infrastructure, and CNG fuel tank replacement for in-use CNG-fueled buses.

1) Emission Criteria

The proposed emission criteria for the Lower-Emission School Bus Program Guidelines purchase requirements for both alternative-fueled and diesel-fueled school buses are given in Table 5 below, along with the certification standards.

Table 5 Proposed Emission Criteria for Use of Lower-Emission School Bus Funding				
	2006 Model Year		2007 - 2009 Model Year	
	HC+NOx (g/bhp-hr)	PM (g/bhp-hr)	NOx (g/bhp-hr)	PM (g/bhp-hr)
Alternative-fueled school buses	1.8	0.01	0.5	0.01
Diesel-fueled school buses	2.5	0.01	1.2	0.01
Mandatory Diesel Engine Standards applicable to school buses	2.5	0.10	1.2[(a)]	0.01
(a) Between 2007 and 2009, U.S EPA requires 50 percent of heavy-duty diesel engine family certifications to meet the 0.2 g/bhp-hr NOx standard. Averaging is allowed, and it is expected that most engines will conform to the fleet NOx average of approximately 1.2 g/bhp-hr				

The proposed NOx emission requirements for alternative-fueled school buses are more stringent than the mandatory standards but are consistent with the levels at which alternative-fueled school bus engines are expected to certify to for these model years. The 2006 requirement is consistent with an optional reduced-emission NOx certification standard, and the 2007 – 2009 requirement was set at 0.5 g/bhp-hr to be consistent with the certification level publicly stated by the leading alternative-fueled school bus engine manufacturer for their 2007 engine.

The NOx emission criteria for diesel-fueled school bus purchases are consistent with the mandatory standards. The 2007 – 2009 NOx emission criterion for diesel-fueled buses was set at the average of the range diesel engines are expected to certify at. The major diesel-fueled school bus engine manufacturers have confirmed that their 2007 school bus engine will certify to meet this level.

The PM emission criteria are set at 0.01 g/bph-hr for the purchase of both 2006 and 2007 - 2009 school buses. These standards are consistent with the previous requirement set in the 2004 Guidelines. It is lower than the mandatory standard for the 2006 engines, requiring the addition of exhaust aftertreatment. This PM standard becomes mandatory for all heavy-duty 2007 – 2009 model year engines.

2) South Coast Air Quality Management District School Bus Fleet Rule

The SCAQMD adopted fleet rules in April 2001 requiring the purchase of alternative-fueled vehicles for certain fleets of 15 or more vehicles, when government funding for the incremental cost is available. SCAQMD Rule 1195, which applies specifically to school bus fleets, includes exemptions which allow diesel-fueled bus purchases in certain cases. However, the exemptions dealing with lack of available infrastructure and the lack of funding for infrastructure have sunsetted. For the past several years, the SCAQMD has only funded alternative-fueled school buses. However, some school districts in the SCAQMD still have an all diesel-fueled school bus fleet. Owners of all-diesel-fueled fleets within the SCAQMD may object to the purchase of an alternative-fueled bus as a replacement or believe that an alternative-fueled vehicle is not practical for their fleet. SCAQMD will work to ensure that the oldest

buses are replaced in their district consistent with 2005-2006 budget language requirements and their local fleet rule requirements.

3) Refueling Infrastructure

An additional consideration unique to the operation of CNG buses is the need for a specialized CNG refueling infrastructure. Where practical, buses may use existing local CNG fueling sites depending on the proximity to the school district bus maintenance facility and allowable access. School districts may need to install a refueling system if an existing local CNG refueling infrastructure is not available. Staff proposes that for the 2006 Guidelines, as in previous guidelines, up to ten percent of new bus funding for alternatively-fueled buses be allowed to be used for refueling infrastructure as needed. This equates to approximately $14,000 of infrastructure funding per alternative-fueled bus purchased. However, costs for dedicated CNG fueling sites can be very high such that a school district would need to be replacing a large number of buses with alternative-fueled buses in order to be granted enough infrastructure funds to build a station. In areas like the SCAQMD, where there are buses to be replaced in fleets without any CNG refueling infrastructure, additional funding may be required from the local air district to provide the refueling infrastructure necessary to support the introduction of alternative-fueled vehicles to these fleets.

While a few independent corporations produce CNG fueling systems that cost about $12,000 per CNG-fueled school bus (to time-fill a single bus), some school districts have indicated that these systems are not practically applicable for school bus fleet use. Estimates for station capital costs can range from about $250,000[8], for a combination of 20 time-fill units and one fast-fill unit, to approximately $320,000[9], for a fast fill station capable of refueling up to 20 school buses overnight. While these costs are on par with the funding allotment of approximately $14,000 per bus, a school would need to be replacing close to 20 buses in order to have sufficient funding to build one of these stations. Since State funds available this year will only replace 15 buses in the South Coast AQMD, and the new buses are divided between a number of different school districts, additional local infrastructure funding will likely be needed if CNG-fueled buses are to be purchased by school districts with no natural gas fueling infrastructure.

4) CNG Tank Replacement

The replacement of CNG fuel tanks that have exceeded their maximum life is a need that currently does not have a designated source of funding. The Department of Transportation mandates CNG fuel tanks must be visually inspected every 3 years or 36,000 miles and replaced after the manufacturer's recommended service life, typically 15 years. A school bus life of 25 years results in the need to replace the natural gas fuel tanks once during the life of the bus. After the fuel tanks on a CNG bus reach their 15 year life, the bus must be taken out of service if the tanks are not replaced.

Staff is not proposing to fund fuel tank replacement with the 2005-2006 FY State budget allocation because the oldest bus first method of fund allocation and the need to accelerate the release of the new bus funds makes funding tank replacement difficult with this funding source. However, staff is proposing that the Guidelines recommend, but not require, that air districts allocate a portion of their AB 2766 funding for this purpose. The passage of AB 2766 authorized revenues collected from the first four dollars of the motor vehicle registration surcharge to be used for the reduction of air pollution from vehicles. Staff believes that funding fuel tank replacement is a cost effective method of keeping lower-emitting school buses on the road. For in-use buses requiring tank replacement in the near future, the replacement and installation cost is approximately $24,000 per bus, based on a typical number of six fuel tanks per bus. This estimate includes $19,000 for materials and $5,000 for labor.

D. Consideration of Match Requirements

1) School District Match

The Lower-Emission School Bus Program Guidelines have historically required a school district match for new bus purchases. The required school district match under existing guidelines for replacing a pre-1977 school bus is $10,000 per replaced bus. Local air districts are allowed to provide the match. Requiring a school district match retains the concept of program buy-in for school districts. However, with the “oldest bus first“ method for allocating the new bus purchase funds, waiving the match may facilitate the replacement of these specific buses by allowing school districts without financial capability to provide match funds to participate. Waiving the match increases the funded amount per bus and drops the estimated number of buses to be replaced by about 7 buses. Staff recommends that the school district match be waived for all pre-1977 buses. Staff would leave it to local air district discretion if they wanted to require a match for buses purchased with AB 923 or other local funds.

2) Air District Match

For the first two years of the program, the Lower-Emission School Bus Program Guidelines required that air districts that administered their own new bus purchase programs contribute their own funds to match 10 percent of their State grant awards. This air district match was eliminated in the 2003 Guidelines Update due to language in AB 425. Under these proposed guidelines, there would still be no required air district match.

E. Impact of the Seat Belt Law

Assembly Bill 15 (AB 15: Statutes of 1999, Chapter 648) initiated a requirement for lap/shoulder belts for all new school buses manufactured on or after January 1, 2002, that are purchased or leased for use in California, unless specifically prohibited by the National Highway Transportation Safety Administration. Implementation was delayed by Senate Bill 568 (SB 568: Statutes of 2001, Chapter 581) until July 1, 2004, for new Type 2 small school buses and until

July 1, 2005, for new Type 1 large school buses. The use of lap/shoulder belts will limit seating capacity on new buses to a maximum of two per seat.

Currently, school districts within California typically transport two older students per seat and three younger students per seat to comply with federal motor vehicle safety standards. Buses that only transport older children, those in seventh through twelfth grade, are not expected to lose seating capacity. However, school buses that currently transport primary school-aged children at a capacity of three children per seat will lose maximum seating capacity. This lower seating capacity of newer buses is further pressure on school districts to retain their older buses.

F. Local Funds

AB 923 requires that the purchase of school buses with these funds be pursuant to the Lower-Emission School Bus Program Guidelines. Additionally, local air districts may choose to use the Guidelines when purchasing school buses with other local funds. However, since these local funds, AB 923 or otherwise, are not subject to the restrictions specified by the 2005-2006 FY budget language, they are not subject to the requirement to target the replacement of pre-1977 school buses, oldest bus first. Air districts may choose to replace pre-1987 in-use diesel buses in addition to pre-1977 school buses. Since PM was essentially uncontrolled until 1987, the air quality benefit of replacing a pre-1987 bus is equivalent to the benefit of replacing a pre-1977 bus.

IV. LOWER-EMISSION SCHOOL BUS RETROFIT PROGRAM

The main goal of the Lower-Emission School Bus Program is to reduce children's exposure to diesel school bus emissions. As school buses typically do not accumulate excessive yearly mileage, averaging about 14,000 miles per year, they remain in service for extended periods of time. Therefore, retrofitting in-use diesel school buses can provide significant emission reductions for many years. These significant reductions are cost-effective and immediate.

The Lower-Emission School Bus Retrofit Program utilizes allocated funding for the purchase of ARB verified emission reduction technologies and their associated maintenance costs. $12.5 million has been appropriated through the State budget process for the retrofit of in-use diesel school buses for the 2005-2006 FY. This funding is expected to retrofit nearly 1,000 in-use diesel school buses. The budget language which appropriated this funding requires that the funding be used for retrofit devices that reduce PM by at least 85 percent. However, staff has included discussions of other levels of reduction in the Guidelines so that the document may be applicable to other sources of funding (such as AB 2766) that are not subject to this requirement.

A. Availability of Ultra-Low Sulfur Diesel Fuel

Catalyzed diesel particulate filters require fuel with a maximum of 15 parts per million (ppm) of sulfur. Higher levels of fuel sulfur result in reduced catalyst efficiencies due to contamination of the catalyst reaction sites. This requirement for

low sulfur fuel has restricted some air districts from embracing the retrofit program in the past. However, starting June 1, 2006, all diesel fuel at production or import facilities will be required to meet the 15 ppm sulfur standard. Beginning September 1, 2006, retail sales of conventional diesel fuel will be required to meet this standard. With the widespread availability of ultra-low sulfur fuel, all air districts should be able to participate in the retrofit program. Since conventional diesel fuel will meet the ultra-low sulfur standard, the ARB will no longer provide the $500 fuel subsidy to fleets participating in the retrofit program that was offered at the program's inception in 2000.

B. Verified Technologies

The ARB verifies the emissions reductions and durability of diesel retrofit devices. Information concerning the diesel emission control devices or strategies which have been verified by the ARB is available on the ARB's Diesel Emission Control Strategies web page: http://www.arb.ca.gov/diesel/verdev/archive.htm. These strategies are categorized into three primary categories, depending on their reduction of PM. Level 1 devices provide greater than 25 percent reduction in PM; Level 2 devices provide greater than 50 percent reduction in PM; finally, Level 3 devices provide greater than 85 percent reduction in PM. The budget language appropriating the retrofit funding for 2005-2006 FY requires retrofit devices that reduce PM by at least 85 percent (Level 3).

The emission control strategies listed on the ARB Diesel Emission Control Strategies web site are verified for specific engine families and engine model years. These are listed in the executive order issued for the verification. Some verification executive orders include specific operating conditions, such as exhaust temperature profiles, that must be met in order for the control device to function properly. When operating conditions are specified in the verification executive order for the retrofit device being considered for installation, it is important that the prospective bus be data logged during normal route operation to verify that these operating requirements are satisfied. Data logging is discussed further in section IV.D. It is recommended that the school bus operator check directly with the control strategy manufacturer or their local distributor to ensure compatibility with the bus engine type and operating requirements when choosing a control strategy.

1) Level 3 Diesel Emission Control Strategies

Level 3 verification requires an 85 percent PM reduction. Currently, all verified Level 3 diesel emission control strategies include a DPF. DPFs are the most commonly available aftertreatment device. Installation involves integrating the DPF into the vehicle's exhaust system. In many cases the DPF replaces the existing engine muffler.

Two basic types of particulate filters are used: passive and active. Active devices require additional energy input to the system in order to burn off the collected soot. Passive devices are designed to burn off this soot without energy input beyond that provided by the engine exhaust gas. Most Level 3 DPF devices utilize passive

technology. In general, passive DPFs remove PM by collecting particles and oxidizing them during vehicle use. The oxidation process is referred to as regeneration. Passive DPFs typically rely on a precious metal catalyst contained in the filter to allow regeneration at common engine exhaust temperatures. The exhaust temperatures required for regeneration may vary from one control strategy to another. Recently, the first Level 3 active DPF device for on-road vehicles was verified. In active filters the regeneration temperature is achieved by means of an external heat source. This typically involves an electric or other heat source to increase oxidation in the filter. The currently verified active filter is uncatalyzed and relies on the operator "plugging-in" the vehicle during the night when the filter requires regeneration.

Under typical vehicle operation, DPF systems do not cause any additional engine wear or affect normal vehicle maintenance. However, DPF devices generally require periodic maintenance to remove ash caused by motor oil combustion residues. This periodic maintenance can be handled by a maintenance contract at the time of device purchase, period cleaning by outside contractor, or cleaning by the bus maintenance personnel. If the bus maintenance personnel perform this function, either a DPF de-asher must be purchased or the DPF must be taken offsite for cleaning. The cleaning option chosen may be based on the number of DPFs to be cleaned, whether buses can be out of service while the DPF is taken off site, and the workload of the maintenance personnel. Cost for cleaning a DPF, baking to remove any residual soot and de-ashing, is approximately $800 per cleaning. A device to clean the filters on-site can be purchased for approximately $13,000. In light of the need to avoid placing non mandated costs on the public school districts, it is recommended that these lifetime cleaning costs be included in the funding of the DPF system. A cost of $4,000 over the 11 year life of the DPF has been used to estimate the number of retrofits possible with the $12.5 million funding for 2005-2006 FY. This estimate was based on the assumption that the DPF requires cleaning once every two years at a cost of $800 per cleaning.

Table 6 below lists the engines commonly applicable to school buses and the model years that can be retrofit with a diesel particulate filter. Retrofit manufacturers include Cleaire, Donaldson, International, Johnson Matthey, and Lubrizol. More complete information on verified Level 3 retrofit devices and the engines and operating requirements for their application can be found at the ARB web site: http://www.arb.ca.gov/diesel/verdev/level3/level3.htm.

Table 6 School Bus Engines Eligible for Retrofit		
Engine Manufacturer	**Applicable Common School Bus Engine Models**(a)	**Engine Model Years**(b)
International	DT 466, DT 466E, T444E, 7.3 L, 6.0 L	Broad applicability for 1994 – 2003.
Caterpillar	3116, 3126, 3176, C-7	
Cummins	B3.9L, B5.9L, C8.3L, ISB, ISC	Partial availability for 1993 and 2004-2006
(a) DPFs are applicable to other engine models (b) Verification as of December 7, 2005. Further verification is currently in progress to potentially include older model year engines.		

2) Levels 1 and 2 Diesel Emission Control Strategies

Level 1 and Level 2 ARB verified diesel emission control strategies may not be funded with the 2005-2006 State retrofit funds. However, they are discussed here to provide a broader application of the Guidelines to other sources of funding, such as Carl Moyer funding. Although technologies verified at Level 1 and Level 2 provide a lower percent reduction in PM, they may provide broader applicability.

Currently there are only two Level 2 technologies verified for on-road application by the ARB Diesel Emission Control Strategies Verification Program. One is a flow through filter and the other an alternative fuel. All of the Level 1 technologies include a diesel oxidation catalyst (DOC). For a number of these Level 1 technologies, the DOC is paired with a crankcase filter. Open crankcase engines can have significant emissions from the crankcase that do not pass through the exhaust system. Test data has indicated that these emissions contribute to poor air quality within the bus cabin.[10] Retrofitting older buses with these devices may result in considerable emission benefits and improvement in bus cabin air quality.

C. Funding Allocations for In-Use Diesel Retrofits – 2005-2006 FY State budget funds

The $12.5 million appropriated through the State budget process for the 2005-2006 FY for the retrofit of in-use diesel school buses, will be allocated to air districts on a per capita basis, as shown in Table 7 below. Approximately 90 percent of the retrofit funding has already been disbursed. These funds have been released to the air districts with greater than one percent of the State's population. These air districts have participated in the retrofit program previously. The remaining funds were pooled to be distributed to the other 26 air districts on an equal basis. Each of the 26 districts will receive a minimum funding allocation of $41,885 in retrofit funds assuming all districts choose to participate. These districts must decide by March 2006 if they wish to participate in the retrofit program and communicate their decision to ARB. Any funding left unclaimed will be reallocated to an air district that is able to obligate additional funds.

Four of the nine air districts shown in Table 7 below have unspent retrofit funds from previous years. These air districts, designated by a footnote in the table below, must obligate prior retrofit funds by March 15, 2006, or submit a plan to the ARB by March 31, 2006, demonstrating their ability to obligate both their prior retrofit funds and the 2005-2006 FY retrofit funds. If the Executive Officer does not approve the plan, a district's 2005 – 2006 fiscal year retrofit funding may be reallocated to other local air districts participating in the retrofit program.

Table 7 Retrofit Funding Allocations (2005 – 2006 FY)

Region	Funds	Approximate # of Retrofits Fundable[(c)]
Air Districts with ≥ 1% of Statewide Population		
Bay Area AQMD[(a)]	$2,395,000	165
Mojave Desert AQMD[(a)]	$153,000	10
Monterey Bay Unified APCD[(a)]	$266,000	18
Sacramento Metropolitan AQMD	$456,000	31
San Diego County APCD	$1,051,000	72
San Joaquin Valley APCD	$1,223,000	84
Santa Barbara County APCD[(a)]	$145,000	10
South Coast AQMD	$5,449,000	375
Ventura County APCD	$273,000	18
SUBTOTAL	$11,411,000	783
Air District Retrofit Pool: Air Districts with ≤ 1% of Statewide Population[(b)]		
All Other Air Districts (26)	$1,089,000	75
TOTAL	**$12,500,000**	**858**

(a) Air districts with unspent retrofit funds from previous years must obligate those funds by March 15, 2006, or submit a plan to ARB by March 31, 2006, in order to receive 05-06 FY retrofit funds.
(b) Each air district in the Retrofit Pool that chooses to participate would receive a minimum allocation of $41,885. Air districts in the Retrofit Pool with unspent retrofit funds from previous years must obligate those funds by March 15, 2006, or submit a plan to ARB by March 31, 2006, in order to receive 05-06 FY retrofit funds.
(c) Approximate number of funded retrofits based on Level 3 PM retrofit device cost of $14,500, Includes up to $4,000 for de-ashing.

1) Budget Language Requirements

The budget language which appropriated the retrofit funds (Appendix B) provided specific guidance regarding the technologies to be funded. These technologies are to reduce particulate matter emissions by at least 85 percent. Additionally, they are to: (a) have at least a level 3 verification from the Board; (b) apply to the broadest range of year, make, and model of school bus diesel engine; (c) operate on CARB diesel fuel or ultra-low sulfur diesel fuel; (d) operate across the broadest range of school bus operating conditions and duty cycles; and (e) produce the lowest possible NO_2 across the device. Compliance with these requirements is discussed in the following paragraphs.

By June 1, 2006, all sales of diesel fuel at production or import facilities will be required to meet the 15 ppm sulfur limit. After this date, California diesel fuel will be ultra-low sulfur fuel. Consequently, all verified Level 3 devices will meet the requirement to operate on California diesel fuel or ultra-low sulfur diesel fuel.

The purchase of a verified Level 3 device is required for this funding. There are many Level 3 verified technologies applicable to school buses; however, not every technology is appropriate for every school bus and every school bus route. Matching the appropriate technology to each bus and route can be accomplished by verifying applicability to the engine family and data logging the bus to determine that the exhaust gas temperatures generated during normal operation meet the regeneration requirements for the device. The consideration of an active filter, which requires the addition of energy, such as an electric resistance heater, to burn off the collected soot, provides a broader range of applicability.

The requirement for broad ranges of applicability and of operability allows more in-use diesel buses to be eligible for retrofit. In order to achieve broad ranges of applicability and operation, a device must be able to handle high soot loading and low exhaust temperatures. These conditions require either an active filter, which requires the addition of energy, such as an electric resistance heater, to burn off the collected soot, or an passive filter with a high catalyst loading, both of which increase the cost of the system.

The last requirement is for funded devices to produce the lowest possible NO_2 across the device. Most catalyzed Level 3 devices generate relatively high levels of NO_2. A verification limit on NO_2 production goes into effect in January 2007 and will be reviewed by the Board by spring 2006. Recently, an uncatalyzed Level 3 device which does not generate NO_2 has been verified. This device requires plugging-into an electrical outlet at a frequency ranging from every night to once every three weeks depending on the emission level of the bus and the bus usage. The budget language favors this type of device. Staff proposes that air districts fund available low NO_2 devices if they are applicable to the available bus engines and if any necessary infrastructure can be installed and funded.

This means that available uncatalyzed active filters should be given priority for funding among the applications received, even if more expensive than catalyzed passive filters. Retrofit funds can be used for reasonable infrastructure costs. Uncatalyzed active filters both operate across broad ranges of school bus operating conditions and duty cycles and do not generate NO_2. If school bus retrofit funding remains unspent after all reasonable applications for uncatalyzed active Level 3 devices are funded, then other Level 3 devices could be funded.

2) Eligible Buses

Buses eligible for retrofit using these State funds are diesel buses with a GVWR greater than 14,000 pounds either owned by public schools or are buses owned by private contractors which are providing service to public schools.

D. Data Logging

To ensure that an appropriate emission control technology is installed on each bus, it is recommended that measurements of the target bus's exhaust temperature profile be taken if the selected control device's verification executive order includes exhaust temperature requirements. Even if a bus engine is in the correct engine family for a specific retrofit device, the bus route may not produce the exhaust temperatures necessary for regeneration of the device. The emission control system vendor needs accurate information on how the buses are operated to select and size a retrofit device. Installing sensors and data logging equipment on buses, prior to retrofit, to gather accurate and complete exhaust temperature data for the vehicles is an important step in selecting the appropriate system. The data logging process requires minimal installation time and does not interfere with normal bus operations.[11] After the assessment, the most appropriate emission control system may be selected and installed. Data logging is recommended for every bus prior to retrofit if the selected control device's verification executive order includes exhaust temperature requirements. It is recommended that $50[12] be included in the retrofit funding to cover the cost of data logging for each prospective bus when applicable.

E. CHP Post-Retrofit Inspection

Title 13 Section 1272 (c) requires that the California Highway Patrol (CHP) inspect a school bus that has undergone any chassis modification. This includes the installation of a retrofit device. This inspection must be performed prior to the bus's return to service. The inspection is to determine if the installation was performed according to the manufacturer's specifications. It is required in order to protect the school district and the children in the case of improper installation.

During annual bus inspections this summer, the CHP discovered some buses with retrofit installations that did not conform to the emission control system manufacturer's specifications. After discovering these faulty installations, the CHP re-inspected all the school buses with emission control system retrofits. Ninety-six percent of these buses passed inspection and four percent of the buses were found to have discrepancies. Through cooperation of the CHP, ARB, and the emission control system manufacturers, most of the faulty installations were corrected and the buses returned to service before the end of August.

Staff proposes that the Guidelines include the requirement that buses receive a CHP inspection after a retrofit device is installed and before the bus is returned to service. Staff proposes that the Guidelines stipulate that this requirement be included in all contract agreements between air districts and public school districts or private companies under contract to public school districts. Additionally, staff proposes that ARB shall report retrofit project information to the CHP. This reported information shall include the entity to which the air district awarded funds, identification of the buses on which the retrofits were installed, and identification of the retrofit device installed. These extra steps will assure that all school bus retrofits receive a CHP inspection for proper installation.

F. Local funds

Air districts may choose to use local funds to retrofit buses. They may choose to retrofit buses in their district not meeting eligibility requirements for State funds, such as those owned by private schools. In evaluating retrofit projects, air districts may choose to retrofit buses ineligible for Level 3 verified devices with Level 1 or 2 devices. The Lower-Emission School Bus Program Guidelines include guidance on these devices to facilitate these local programs.

V. ISSUES

A. Allocation Options

Three different funding allocation options were presented at the October 14, 2005 workshop. These options include 1) replacing the oldest buses first, 2) an allocation based on pre-1977 school bus population, and finally, 3) the historical per capita funding allocation.

The bus population data base has been refined since the October 2005 workshop. The workshop data base was obtained from CDE based on a voluntary survey of school districts. To increase the accuracy of the data, staff obtained school bus population data from the CHP based on their school bus safety certification records. Staff conducted a phone survey of the school districts whose fleets included a 1974 model year bus or older to confirm that these buses were still active in their fleets. The survey results showed that only approximately one-third of these buses listed in the data base were still used either regularly or as a back-up bus. Staff collected information about all of the pre-1977 school buses in the fleets that they contacted. The allocations based on the bus populations were updated based on these refined survey data.

Table 8 presents a comparison of the allocation criteria for the three different allocation methods. This table shows only the five largest air districts. A table showing all the applicable air districts is provided in Appendix E. An estimate of the funding and corresponding number of new buses for the three allocation methods is given in Appendix E.

Table 8 Comparison of New Bus Funding Allocation Criteria for the Five Largest Air Districts			
Air Districts	Funding Allocation Based On:		
	% of Oldest Buses (Pre-1973)	% of Pre-1977 Bus Pop.	% of People Pop.
Self-Administered Program			
San Joaquin Valley APCD	34%	46%	10%
South Coast AQMD	17%	12%	44%
Bay Area AQMD	4%	9%	19%
San Diego County APCD	N/A	<1%	8%
Sacramento Metropolitan AQMD	N/A	<1%	4%
Remaining Air districts	45%	32%	15%
Total	100%	100%	100%

As can be seen, the allocation criteria make a significant difference in determining the percentage of funds for each air district. Several air districts have argued that they have proactively spent their own funds over the past several years in reducing the number of older school buses within their region and should not now be penalized for those positive actions. Staff believes these arguments have merit; however, there is also merit in providing an extra boost for those school districts and air districts that haven't had the funds to replace older school buses in the past. Staff is proposing to allocate these State funds on an oldest bus first criteria consistent with the legislative direction.

B. Alternative-fueled and Conventional-Fueled Bus Purchases

ARB is proposing to give school districts the choice of either a diesel-fueled or alternative-fueled school bus as a replacement bus. There is a significant reduction in bus exhaust emissions and an improvement in cabin air quality whether the pre-1977 bus is replaced by a new alternative-fueled bus or a new DPF equipped diesel-fueled bus. Staff believes that requiring the purchase of an alternative-fueled bus could result in some of the oldest buses not being replaced in school districts without access to alternative fuel refueling facilities. One exception to allowing choice is in the SCAQMD, which has a local regulation that requires any new school bus purchase made be alternative-fueled unless grant funding is not available for the incremental cost of the alternative-fueled bus (see in section III.C.2). While purchasing an alternative-fueled bus provides a reduction in NOx over the diesel-fueled bus purchase, the lower price of the diesel-fueled bus allows more pre-1977 buses to be replaced for a set funding amount if diesel-fueled buses are purchased rather than alternative-fueled buses. The following paragraphs discuss this trade-off.

1) Emissions/Cost Trade-off

Table 9 shows, as an example, the number of CNG or diesel buses that may be purchased if the entire $12.5 million in funding were to be spent on a single fuel type. This analysis assumes that all buses purchased are 2007 model year buses.

The assumed average bus prices shown in the second column of Table 9 do not include sales tax or infrastructure funding. The funded amounts shown in the third column of Table 9 include sales tax and a range for alternative-fueled bus funding with and without the allowable 10 percent for refueling infrastructure. About 20 to 30 percent fewer buses are purchased for a set funding level if alternative-fueled buses are purchased rather than diesel-fueled buses.

Table 9 CNG / Diesel Bus Purchase Trade-off

Fuel Type	Assumed Avg. Bus Price (pre-sales tax)	Funded Amount with Sales Tax and 10% Infrastructure Funding for Alternative-Fuel	# of buses if $12.5M spent on single fuel type [a]
CNG	$144,000	$155,000 - $169,000[b]	74 - 81[b]
Diesel	$115,000	124,000	101

(a) 7.75 percent sales tax and no school district match included in calculation
(b) Range from no infrastructure funding needed to 10 percent of funds for infrastructure

Replacing a pre-1977 bus with either a 2007 alternative-fueled or diesel-fueled bus provides a significant near-term emission benefit of about 1.5 pounds per day of NOx and about 0.08 pounds per day of PM. That benefit is due to fleet turnover - the new bus has significantly lower emissions than the old bus. However, the benefit would continue only as long as the old bus would have remained on the road. For most heavy-duty vehicles, the remaining life of an older vehicle is assumed to be three to five years. The ARB is currently assessing whether it is appropriate to assume a longer remaining life for school buses.

For bus replacement with a new alternative-fueled bus, the alternative-fueled bus is certified to a lower NOx level than required. Therefore alternative-fueled bus replacement would provide an additional NOx benefit of 0.1 pounds per day. This additional benefit would last for the lifetime of the new bus.

VI. EMISSION BENEFITS

The ARB staff estimates that the retrofit of about 860 in-use diesel school buses funded by the 2005-2006 FY State budget allocation of $12.5 million will reduce PM emissions by approximately 45 to 60 tons over the lifetime of the retrofit devices. This estimate assumes that each retrofit device has an 11 year life in school bus applications. The range in retrofit emission benefits is due to the uncertainty in which Level 3 devices will be purchased and the age of the engines to be retrofit.

ARB staff used the EMFAC2002 emissions model to estimate the emission benefits associated with replacing 90 pre-1977 school buses with 2007 model year buses to be about 135 pounds per day of NOx and 7 pounds per day of PM. It was assumed that all new bus purchases were 2007 model year. These reductions reflect the immediately realized benefits from replacing an old, pre-1977 bus with a new 2007 model year bus. This analysis does not attempt to estimate the remaining life of the older buses or calculate the lifetime emission benefits of school bus replacement.

ARB staff will address these issues as it evaluates a potential fleet modernization program for school buses as part of the Carl Moyer Program.

These emission benefit calculations are discussed in more detail in Appendix G

VII. ENVIRONMENTAL JUSTICE

For the 2005-2006 FY State funds now available for new school bus purchases, the Legislature has directed that the funds be used to replace the oldest buses in California first. Therefore, the funds will be used to replace specific pre-1977 school buses in public school districts identified by ARB staff as having the oldest school buses in California. That legislative directive takes precedence over environmental justice criteria for state school bus funding. For AB 923 funding, and for other air district funding, ARB encourages air districts to consider environmental justice and therefore a discussion of environmental justice criteria follows.

It is important that school bus projects benefit all communities of California, particularly those disproportionately affected by air pollution. Health and Safety Code section 43023.5 requires air districts with populations greater than one million inhabitants to distribute not less than 50 percent of the funds appropriated by the State Legislature for the purchase of new, lower-emitting school buses to directly reduce air contaminants or the associated public health risk in communities with the most significant exposures, including communities of minority populations and/or low-income populations. The ARB, CEC, and local air districts have worked cooperatively to implement this requirement affecting State funding appropriations within the Lower-Emission School Bus Program beginning in 2001, when the statute first went into effect. This requirement remains in effect until January 1, 2007, unless subsequent legislation deletes or extends the date.

While Health and Safety Code section 43023.5 affects only State funding appropriations, the ARB encourages air districts to expend their local AB 923 funds dedicated to new school bus purchases, and other local funds used for new school bus purchases, in a manner consistent with the Health and Safety Code provision. In addition, the ARB also encourages air districts not subject to Health and Safety Code section 43023.5 (i.e., those air districts with less than one million inhabitants) to expend their local funds for new school bus purchases in a similar manner.

To assist air districts in their efforts to focus funds for new school bus purchases in communities pursuant to Health and Safety Code section 43023.5, the ARB has developed recommended criteria for use in the Lower-Emission School Bus Program. These criteria would be used primarily by air districts, should they choose to do so, in expending their local funds on new school bus purchases since the 2005-2006 FY State funds are targeted directly at removing the oldest buses in the fleet first. While the ARB recognizes that communities disproportionately affected by air pollution are not limited to low-income communities and/or communities of color, the ARB-recommended criteria use the percentage of students within a public school district participating in the free and reduced-lunch meal program as a way to identify

a region in which to target funds for new school bus purchases. Alternatively, air districts may develop different criteria, in consultation with the ARB staff, to identify communities in which to focus funds for new school bus purchases.

VIII. REFERENCES

1. Replacing California's Older School Buses Provides for Cleaner Air and Safer Students. April 19, 2005. http://republican.sen.ca.gov/opeds/14/Oped2707.asp

2. Federal Motor Vehicle Safety Standards. http://www.stnonline.com/stn/government/fmvssregulations/1392_usc_15.htm

3. Epidemiologic Investigation to Identify Chronic Effects of Ambient Air Pollutants in Southern California. May 14, 2004. Abstract for ARB Contract No. 94-331.

4. Characterizing The Range Of Children's Pollutant Exposure During School Bus Commutes. April 26, 2004. Abstract & Summary for ARB Contract No. 00-322. www.arb.ca.gov/research/schoolbus/report.pdf

5. Children's School Bus Exposure Study. www.arb.ca.gov/research/schoolbus/schoolbus.htm

6. ARB Staff Interpretative Summary of Study Results, "Briefing Paper: "Characterizing the Range of Children's Pollutant Exposure during School Bus Commutes" Contract Number 00-322, October 2003.

7. ARB web site "The Children's Health Study," http://www.arb.ca.gov/research/chs/chs.htm

8. *Rule 1195 Staff Report, "Proposed Rule 1195—Clean On Road School Buses," Author: Ali R. Ghasemi, SCAQMD, April 2001.*

9. "*Draft White Paper: Results of School Bus and Infrastructure Survey," Author: Von Loveland, January 2005.*

10. Clean Air Task Force, "A Multi-City Investigation of the Effectiveness of Retrofit Emissions Controls in Reducing Exposures to Particulate Matter in School Buses," *Authors: L. Bruce Hill, Ph.D., Neil J. Zimmerman, Ph.D., CIH, James Gooch,* January 2005. http://www.catf.us/publications/reports/CATF-Purdue_Multi_City_Bus_Study.pdf

11. MECA, Diesel Retrofit, http://www.meca.org/galleries/default-file/retrofitFAQ_(revised).pdf, accessed November 2, 2005.

12. Reynolds, Jim, A-Z Bus Sales, Inc., Letter to Krista Fregoso dated September 27, 2005.