
# Washington State Clean School Bus Program

## Report to 2005 Legislature

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# Executive Summary

School buses are the safest way to transport children to and from school. Each school day, nearly 475,000 children in Washington ride more than 9,000 school buses on over 20,000 routes, totaling more than 90,000,000 miles annually. The Washington State Clean School Bus Program guarantees real and immediate health benefits, ensuring both a safe and healthy mode of transportation for nearly half a million children.

## *Washington State Clean School Bus Program*

In 2003, the state legislature passed Engrossed Substitute Senate Bill (ESSB) 6072. The legislation established funding for the "Washington State Clean School Bus Program," and launched a collaborative effort to reduce children's exposure to diesel exhaust and the amount of air pollution created by diesel school buses. Cleaner emissions can be achieved by retrofitting bus engines with emission control equipment, or by substituting diesel fuel with cleaner burning fuels such as biodiesel or ultra-low sulfur diesel. The program supports these actions by providing school districts with the necessary funds and technical help to make these changes.

The legislature acted because of growing concerns over the health risks posed by diesel emissions, especially on children. Diesel particles can make asthma worse and can trigger bronchitic symptoms in children. The landmark California Children's Health Study recently found that children exposed to air pollution, including diesel exhaust, have a significant reduction in lung growth and development, potentially leading to permanent lung damage as adults. The study also shows that reducing exposure to air pollution results in healthier lungs, and may reduce other associated health problems.

The program is voluntary and is administered by the Department of Ecology, the state's seven local air quality agencies, and the State Office of the Superintendent of Public Instruction (OSPI). Program funding is derived from vehicle transfer fees, as provided under RCW 46.12.080, 46.12.170 and 46.12.181. These fees are estimated to generate revenue of $5 million per year, or approximately $25 million over the five-year life of the account, which ends on July 1, 2008.

## *First Year Results*

The first year of the Clean School Bus program is now complete, and program results are reported through September 30, 2004. Early months of the program focused on project design, with the last six months dedicated to school bus retrofits. At the outset, Ecology, local air quality agencies, and OSPI formed a workgroup to evaluate technical issues, to provide educational outreach to school districts, to design the program, and to develop a retrofit schedule. During this period, the workgroup completed a number of essential program tasks including:

- Surveying school districts and assessing bus fleet characteristics;
- Identifying and selecting emission control equipment;
- Establishing a centralized state contract for purchase and installation of hardware;
- Establishing a financial management system.

## Retrofitting Buses

Once the essential tasks were complete, the program began retrofitting buses. Because retrofitting older pre-1994 buses provide ten to one hundred times greater emission benefits, these buses are targeted early in the program.

- First, retrofit model year 1982-2000 school buses with diesel oxidation catalysts and crankcase ventilation filters.
- Second, retrofit model year 2001 and newer school buses with diesel particle filters and crankcase ventilation filters.

The school bus retrofit program has already proved successful in its first year of operation.

- The program retrofitted 1,221 school buses at 212 school districts in 38 counties.
- During the writing of this report, air quality agencies retrofitted another 530 buses and received delivery of an additional 900 retrofit kits.

More importantly, these 1,221 retrofitted buses are providing significant annual emission reductions: 28.3 tons of carbon monoxide, 8.5 tons of hydrocarbon, and 4.8 tons of particulates.

These retrofits exceeded first year targets by more than 400 buses. In addition, the Northwest, Puget Sound, and Spokane clean air agencies retrofitted another 400 school buses using a combination of federal and local funds obtained prior to ESSB 6072. These early, local air agency efforts provided the ground work for successfully coordinating a statewide program. As a result, the program is well ahead of its retrofit target and is in good shape to meet the second year's retrofit schedule.

## Cleaner Fuel Projects

Using state funds the program completed one clean fuel infrastructure project and two clean fuel projects. These projects offset the cost differential of purchasing cleaner fuels. Even without retrofit technology, use of either biodiesel or ULSD can provide a 5 to 10 percent reduction in fine particle emissions.

- Ecology's Eastern Regional Office and Spokane Clean Air Authority: A pilot project to purchase biodiesel (20 percent biodiesel blend, B20) for the Central Valley School District in Spokane.
- The Puget Sound Clean Air Agency: Purchase ultra-low sulfur diesel (ULSD) fuel at Bainbridge Island and South Kitsap school districts.
- The Olympic Region Clean Air Agency: Purchase B20 for the Jefferson Transit Administration.

## Costs and Economic Contributions

The program spent a total of $1,845,644 on the items below:

- $1,616,885 on retrofits,
- $100,163 on cleaner fuel and related projects, and
- $128,595 on administrative costs (2 percent of total revenue).

Program retrofits and special projects also provided the following:

- $1,616,885 to the private sector economy,
- $366,000 directly funded in-state labor to install retrofit technology, and

## First Year Savings

To maximize the benefits of state funds, the program successfully negotiated bulk equipment orders that saved 25 percent per retrofit kit ($425/kit), for a total savings to date of $518, 925. Also, the Northwest, Olympic Region, Puget Sound, and Southwest clean air agencies used state funds to leverage $366,000 in federal funds from EPA's Clean School Bus USA Program. EPA's Clean School Bus USA has recognized the Washington program as a model program for other states. These funds retrofitted school buses in rural districts and offset the cost of ultra-low sulfur diesel fuel.

## *Future Years*

Going into the second year, the program will have carry-forward funds of $4,295,492. These funds are important because retrofit expenses will continue to increase and eventually overwhelm program revenues. The original legislative budget request for $25 million anticipated retrofitting 5,000 school buses. Savings from the state contract will enable the program to retrofit about 7,500 school buses. Approximately 8,000 public school buses and 1,000 privately owned school buses are eligible for retrofits, not including the purchase of an additional 800 to 850 new school buses. Retrofitting all of these buses will cost an estimated $29-$36 million dollars, creating a shortfall of $16-$23 million dollars.

## *Leadership*

During a period of economic slowdown and record budget deficits, the Washington State Legislature demonstrated great leadership by funding a program that guarantees real and immediate benefits that improve children's health. Because of the Washington State Clean School Bus Program, Washington's school bus fleet will rank among the cleanest in the nation, and nearly 500,000 children will breathe cleaner air.

# WA Clean School Bus Program
# Report to Legislature

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# Section I: Introduction

The 58th Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6072, effective July 27, 2003. The passage of this bill enabled the establishment of the "Washington State Clean School Bus Program," a collaborative effort designed to reduce children's exposure to diesel exhaust and reduce the amount of air pollution created by diesel school buses. The program provides technical and funding support to school districts to reduce emissions through engine retrofits, cleaner fuels, and clean fuels infrastructure.

Program funding is derived from fees collected from the transfer of motor vehicle ownership, as provided under RCW 46.12.080, 46.12.170 and 46.12.181. These fees are estimated to generate revenue of $5 million per year, or approximately $25 million over the life of the account, which ends July 1, 2008.

The program is voluntary, administered by the Department of Ecology, the state's seven local air quality agencies, and the State Office of the Superintendent of Public Instruction (OSPI).

The participating local air quality agencies include:

- Benton County Clean Air Agency (Benton County)
- Northwest Air Pollution Authority (Island, Skagit, and Whatcom Counties)
- Olympic Region Clean Air Agency (Clallam, Gray's Harbor, Jefferson, Mason, Pacific, and Thurston Counties)
- Puget Sound Clean Air Agency (King, Kitsap, Pierce, and Snohomish Counties)
- Southwest Clean Air Agency (Clark, Cowlitz, Lewis, Skamania, and Wahkiakum Counties)
- Spokane Clean Air Authority (Spokane County)
- Yakima Regional Clean Air Authority (Yakima County)

The participating agencies formed a joint steering committee to design the program and successfully implement a statewide effort to reduce school bus diesel emissions.
The goals of the program include:

- Significantly reduce air pollution and public health risk from school bus emissions;
- Maximize cost-effectiveness and efficiency in use of appropriated dollars;
- Sustain or increase private sector employment;
- Fully track use and effects of dollars spent; and,
- Ensure geographic distribution of program benefits.

The program has a five year operational life, ending in June, 2008. Early months of the program focused on program design, with the last six months dedicated to school bus retrofits. During the first six month period, the workgroup completed a number of essential program tasks including:

- surveying interested school districts and assessing bus fleet characteristics;
- identifying, verifying and selecting emission control equipment;
- establishing a centralized state contract for hardware purchase, installation and maintenance;
- establishing information collection, tracking and financial management systems;
- establishing implementation schedules for bus retrofit activities.

The final four years of the program focus on implementing these activities. Early goals targeted retrofitting 5,000 school buses with emission control devices. Due to savings from a state retrofit contract that takes advantage of bulk orders, the program now anticipates retrofitting about 7,500 school buses with the $5million. However, this savings will be insufficient to cover the cost to retrofit all of the states publicly and privately owned school buses. The program also anticipates completing 10 clean fuel infrastructure projects within this timeframe. These goals will be regularly reviewed and updated.

Local air quality agencies have also used local and federal funds to retrofit school buses.

- Prior to ESSB 6072, and development of the Washington State Clean School Bus Program, the Northwest Air Pollution Authority, the Puget Sound Clean Air Agency, and the Spokane County Air Pollution Control Authority retrofitted approximately 400 school buses using local funds.
- In order to extend the benefits provided by ESSB 6072 funds, the Northwest Air Pollution Authority, the Olympic Region Clean Air Agency, the Puget Sound Clean Air Agency, and the Southwest Clean Air Agency jointly partnered to use $122,000 of ESSB 6072 funding to leverage $366,000 of federal funds from EPA's Clean School Bus USA Program to retrofit school buses and offset the cost differential for providing ultra-low sulfur diesel to school districts.

The program has now passed its first year milestone. This report provides an overview of where the program is currently, how it got to this point, and whether the program is on target to reach its objectives. Washington State school districts operate more than 9,000 school buses statewide, serving 296 school districts and over 475,000 students. The safe transportation of these students is of primary concern. The successful completion of this program is helping the state meet this goal by reducing school children’s exposure to diesel emissions.

## Section II: Health Impacts from Diesel Exhaust

Diesel engines emit a complex mixture of gaseous pollutants and fine particles that include over forty cancer causing substances. Diesel exhaust accounts for more than 80 percent of the associated cancer risk from air toxics in Washington. Breathing diesel exhaust is responsible for an increase in cases of asthma, emergency room visits, and increased cancer risk over a lifetime. Children are more sensitive to pollutants in diesel exhaust than adults because children breathe more air relative to their body weight and because their lungs are not fully developed.

Diesel emissions impact the health of children in a number of negative ways. Because diesel particles are allergens and also act in concert with other allergens, they are a potent trigger for making asthma worse. Recently published data collected by the state of California, found that organic carbon from fine particles and nitrogen oxides (including that formed in diesel exhaust) is associated with bronchitic symptoms in children. The California Children's Health Study collected ten years of data for more than 55,000 children at 52 schools in twelve southern California communities to track how outdoor pollution affected children's health. The study shows that air pollution, including diesel particles and the building blocks that form ozone, not only make asthma worse, but cause asthma in children that have not previously had it. Exposure to acidic gases and fine particles caused decreased lung function in children, and this damage could increase the possibility of chronic respiratory disease as children grow to adulthood. Children exposed to ozone have significant increases in school absences, due to upper and lower respiratory illness.

The good news from this study is that children continued to be studied as they moved from one community to another. Children who moved to cleaner communities with lower particle levels showed improvements in their lung function growth rates. This means that the damage to the lungs in children exposed to air pollution can get better, if particle levels are reduced.

This also means that other ways of reducing children's exposure to diesel particles, such as the school bus retrofit program, will result in healthier lungs in children. It will also reduce asthma triggers, and is likely to reduce the number of new asthma cases in children no longer exposed to high levels of diesel exhaust.

# Section III: Summary of ESSB 6072

The 58th Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6072, effective July 27, 2003. Appendix A contains a copy of ESSB 6072. Among its other provisions, ESSB 6072 created a separate sub-account within the air pollution control account. Funds from this account are to retrofit school buses with emission control technology, or to fund refueling infrastructure necessary for school bus fleets to use cleaner, alternative fuels.

The account is funded from fees collected from the transfer of an owner's interest in a motor vehicle, as provided under RCW 46.12.080, 46.12.170 and 46.12.181. These fees are estimated to generate revenue of $5 million per year, or approximately $25 million over the life of the account, with a currently scheduled sunset date of July 1, 2008.

The Department of Ecology (Ecology) retains 15 percent of these funds and distributes the remaining 85 percent to the local air agencies in direct proportion to the amount of fees collected from counties within each agency's jurisdiction. For counties where there is no local air agency, Ecology retains their portion of funds and spends them within the county in accordance with the purposes of ESSB 6072.

The purpose of ESSB 6072 is to reduce school children's exposure to airborne particulates generated by diesel school buses. Therefore, 85 percent of the funds received by both Ecology and local air agencies must be used to retrofit school buses with emission control equipment, or provide funding for school bus refueling infrastructure necessary to use alternative, cleaner fuels. The remaining 15 percent of these funds may be used as above, or to reduce motor vehicle emissions, clean up air pollution, or monitor and reduce toxic air contaminants.

# Section IV: First Year Results

As of September 30, 2004, the program:

- Retrofitted 1,221 school buses at 212 out of 296 school districts in 38 out of 39 counties. This exceeds the first-year retrofit goal by more than 400 school buses. During the writing of this report, air quality agencies retrofitted another 530 buses and received delivery of an additional 900 retrofit kits.
- Spent $1,845,614 of the $6,141,136 available revenue, leaving a balance of $4,295,492. During the writing of this report, air quality agencies completed an additional $650,000 worth of work.

The balance of available revenue is due to several factors:

- The first year of the program focused on retrofitting older, more polluting buses with diesel oxidation catalysts, which cost significantly less than retrofitting newer buses with diesel particle filters.
- The market price of diesel oxidation catalysts significantly decreased in 2003.
- The state contract takes advantage of bulk orders that result in a savings of 25 percent per retrofit kit, and,
- The required startup time to develop a statewide retrofit program meant that no money was spent on retrofit installations for the first seven months of the program.

The General Administration's Office of State Procurement, the Department of Ecology, and the state's local air agencies all designated development of a state contract for this program as a high priority. This collaborative effort resulted in a state contract that was awarded by a competitive process in exactly four months. The contractor immediately began the first fleet school bus surveys, and the first buses were retrofitted during the spring break period of 2004. The state contractor completed the majority of year one retrofits during the summer vacation period. During development of the state contract, the Puget Sound Clean Air Agency implemented separate retrofit contracts. Under these independent contracts, diesel oxidation catalysts were installed on 218 buses at seven school districts in three counties.

Summaries for year-one goals, objectives/tasks/targets, and performance measures are provided in this section. Appendix D, Year One Results by School District, contains detailed information for measuring the program performance.

## *Year-One Goals:*

- **Significantly Reduce Air Pollution and Public Health Risk from School Bus Emissions**

These retrofitted buses are providing significant annual emission reductions: 28.3 tons of carbon monoxide, 8.5 tons of hydrocarbon, and 4.8 tons of particulates. Bus drivers and

mechanics reported noticing a significant difference in the reduction in the smell of diesel exhaust on buses that were retrofitted.

The California Children's Health Study has documented that reducing air pollution improves children's health. However, scientists have not quantified the improvements in children's health resulting from retrofitting school buses. Because retrofitting school buses does decrease children's exposure to diesel emissions, the Department of Ecology has provided EPA grant funds to the University of Washington to develop a comprehensive study to measure these effects.

- **Use Appropriated Dollars Efficiently**

The state contract takes advantage of bulk orders that result in a savings of 25 percent per retrofit kit ($425/kit) when compared to previous retrofit projects. To date, these program savings amount to $518,925 for 1,221 retrofits.

Program revenue and expenditures are as follows:

| Revenue | Retrofits Expenditures | Administrative Expenditures | Other Expenditures* | Total Expenditures | Balance |
|---|---|---|---|---|---|
| $6,138,067 | $1,616,885 | $128,595 | $100,163 | $1,845,644 | $4,292,423 |

*Other expenses include cleaner fuel infrastructure projects and some education outreach efforts that promote the retrofit program.

Second year administrative costs should remain relatively fixed, while second year expenditures should more than double. Future administrative costs should hold constant at approximately three percent.

The original legislative budget request for $25 million (five years at $5 million per year) anticipated retrofitting 5,000 school buses. Recent planning estimates that $25 million will retrofit about 7,500 school buses, depending on the selected technologies, and the price of these technologies. Approximately 8,000 public school buses and 1,000 privately owned school buses are eligible for retrofits, not including the purchase of an additional 800 to 850 model year 2005 and 2006 school buses.

To extend the benefits provided by ESSB 6072 funds, the Northwest Air Pollution Authority, the Olympic Region Clean Air Agency, the Puget Sound Clean Air Agency, and the Southwest Clean Air Agency jointly partnered to use $122,000 of state funds to leverage $366,000 of federal funds from EPA's Clean School Bus USA Program.

- **Sustain or Increase Private Sector Employmen**t

Program retrofits and special projects directly provided $1,616,885 to the private sector economy, of which $366,000 directly funded in-state labor to install retrofit technology. Both of these figures should more than double during the second year of the program.

- **Fully Track Use of Dollars**

Local air quality agencies independently manage their program budget and track their fiscal records. These agencies report their quarterly expenditures to the Department of Ecology. Ecology compiles and summarizes these quarterly reports into an annual program report.

- **Ensure Statewide Geographic Equity**

The state contract is written to insure statewide geographic equity. Rural school districts pay the same price to retrofit their school buses as urban school districts.

- **Achieve 100 Percent Customer Satisfaction**

The program's customers are the school districts. Retrofits must not hinder the performance of school buses, or inconvenience any route scheduling. The state contractor is highly experienced with both servicing engines and with retrofitting vehicles. The program has received zero complaints from school districts, and many superintendents, principals, fleet managers, and mechanics have praised the performance of the program. No program of this magnitude operates without encountering challenges. The program is dedicated to quickly identifying and correcting any problems.

# Section V: First Year Fiscal Summary

ESSB 6072 requires that program revenue fund retrofits in counties where the fees are collected. Revenue for the first year of the program was $5 million. As of September 30, 2004 the program spent $1,845,644 out of $6,138,067, leaving a balance of $4,292,423. Appendix E contains the local air quality agency fiscal reports.

**Fiscal Summary (7/01/03-9/30/04):**

| Quarter | Period | Carry Forward* | Quarterly Revenue | Total Expenses |
|---|---|---|---|---|
| 1st QTR | 7/01/03-9/30/03 | 0 | 1,250,000 | 66,640 |
| 2nd QTR | 10/01/03-12/31/03 | 1,183,360 | 1,250,000 | 25,004 |
| 3rd QTR | 1/01/04-3/31/04 | 2,408,356 | 1,250,000 | 193,237 |
| 4th QTR | 4/01/04-6/30/04 | 3,465,119 | 1,250,000 | 621,794 |
| 5th QTR | 7/01/04-9/30/04 | 4,093,325 | 1,138,067 | 938,968 |
| Sum | 7/01/03-9/30/04 | $4,292,423 | $6,138,067 | $1,845,644 |

*Carry Forward = Revenue minus expenses; each quarter will be cumulative.

**Balance as of 9/30/04: $4,292,423**

Summary of Air Agency Duties:

The Department of Ecology oversees the program, while local air quality agencies provide local project management and service to their customer school districts.

The Department of Ecology:

- disperses program revenue to local air quality agencies and tracks expenditures,
- manages the program's state contract,
- coordinates activities among local air quality agencies, and
- reports program results to the state legislature.

Local air quality agencies solicit:

- school districts participation,
- make final decisions on the appropriate technology for individual school buses,
- provide quality control and quality assurance,
- track local expenditures, and
- provide progress reports to the Department of Ecology.

Program Expenses:

| Quarter | Period | Retrofit Expenses | Administrative Expenses | Other Expenses | Total Expenses |
|---|---|---|---|---|---|
| 1st QTR | 7/01/03-9/30/03 | 53,480 | 13,160 | 0 | 66,640 |
| 2nd QTR | 10/01/03-12/31/03 | 0 | 24,951 | 53 | 25,004 |
| 3rd QTR | 1/01/04-3/31/04 | 150,049 | 28,645 | 14,542 | 193,237 |
| 4th QTR | 4/01/04-6/30/04 | 522,554 | 30,195 | 69,045 | 621,794 |
| 5th QTR | 7/01/04-9/30/04 | 890,802 | 31,643 | 16,523 | 938,968 |
| Sum | 7/01/03-9/30/04 | $1,616,885 | $128,595 | $100,163 | $1,845,644 |

Administration:

Total administrative expenses for local air quality agencies plus the Department of Ecology are 2.1 percent of the total revenue. The Department of Ecology's headquarters administrative costs are 0.5 percent of the total revenue, and should remain constant over time. As the number of retrofits increase in the second through fifth year of the program, overall administrative costs are expected to increase, but not exceed 3 percent of total program revenues.

Administrative Costs:

| | |
|---|---|
| % of Total Revenue for All Air Quality Agencies | 2.1% |
| % of Total Revenue for Ecology Headquarters | 0.5% |

# Section VI: Five-year Budget Assessment

## *Summary*

The original legislative budget request for $25 million (five years at $5 million per year) anticipated retrofitting 5,000 school buses. Savings from the state contract will enable the program to retrofit more school buses then originally estimated. Current long-term budget planning estimates that $25 million will retrofit approximately 7,500 school buses, depending on the selected technologies, and the price of these technologies. Approximately 8,000 public school buses and 1,000 privately owned school buses are eligible for retrofits, not including the purchase of an additional 800 to 850 model year 2005 and 2006 school buses.

Two retrofit scenarios are analyzed to develop a range of funds required to retrofit these 9,850 school buses. Retrofitting all of these buses will cost an estimated $29-$36 million dollars, creating a shortfall of $16-$23 million dollars.

Five Year Fiscal Summary:

| | Retrofit Public Fleet | Retrofit Private Fleet | Clean Fuels Projects | Admin. | Total Cost | Revenue | Shortfall |
|---|---|---|---|---|---|---|---|
| Min | $35,817,000 | $7,600,000 | $3,750,000 | $515,000 | $40,812,000 | $25,000,000 | $15,812,000 |
| Max | $28,947,000 | $7,600,000 | $3,750,000 | $515,000 | $47,682,000 | $25,000,000 | $22,682,000 |

## *Detailed Assessment*

The five-year budget assessment can best be understood by analyzing the state's school bus fleet by grouped model years and the appropriate type of retrofit technology.

Retrofits by bus classification:

School buses are classified by Type-A, -B, -C, and -D. Type-A buses are constructed on a van-type or cutaway front-section vehicle, with a gross vehicle weight generally less than 10,000 pounds. Type-A buses have an expected school bus service life of 10 years or 150,000 miles. Many model year 1998 and newer Type-A buses have factory-installed diesel oxidation catalysts. Since the expected service-life of model year 1997 and older Type-A buses is three years or less, the program does not anticipate the retrofit of Type-A school buses. The program will retrofit all model year 1982 and newer Type-B, -C, and -D school buses that do not already have emissions control technology.

The following discussion presents selected retrofit technologies by model years. In general, this breakout holds true for the majority of retrofits, although some technology overlap may occur

between selected model year bins. For example, some model year 2000 buses have been retrofitted with DPF technology, while other model year 2001 buses have required a DOC rather than a DPF.

Model year 1982-2000 school buses: diesel oxidation catalysts and crankcase ventilation filters:

The cost to retrofit model years 1982-2000 school buses can be reasonably assessed, since the state contract contains specific prices for retrofit technologies to be applied to these model years. Approximately 5,500 to 6,000, model years 1982-2000, public school buses qualify for retrofit technology. The cost to retrofit 5,500 to 6,000 model years 1982-2000 school buses with some type of diesel oxidation catalysts (either ceramic or wire mesh substrate), and crankcase ventilation filters is estimated to range from $13,831,000 to $16,859,000. The actual cost will depend on the total number of buses that are retrofitted and the type of diesel oxidation catalysts. (This range does not reflect the reduction in DOC costs for the second year of the state contract.) It is anticipated that some buses may be ineligible for retrofit because of maintenance reasons. Other buses may be scheduled for early retirement or out-of-state sale, or may be equipped with factory-installed diesel oxidation catalysts. No additional maintenance costs are required for the retrofit technologies chosen for these model year buses.

Model year 2001-2006 school buses: high-performance diesel oxidation catalysts and crankcase ventilation filters, or diesel particle filters and crankcase ventilation filters:

The program does not currently have a state contract for diesel particle filters, so prices for filters must be estimated based on other state or local agency contracts. The current retrofit price for particle filters ranges from $7,000 to $17,000 per vehicle, with an associated annual maintenance cost expected to average about $300 per bus. The use of filters on school buses is still relatively new so that precise on-going maintenance costs remain unknown. The state currently owns about 1,670 model year 2001-2005 buses. Assuming the state will purchase an additional 800-850 new buses during the next two years, then approximately 2,500 school buses will be eligible for retrofit with particle filters.

Retrofitting 2,500 model years 2001-2006 school buses with crankcase ventilation filters and with the least expensive particle filters is estimated to cost $18,958,000. Annual maintenance cost for these 2,500 school buses retrofitted with particle filters is expected to average $750,000. Model year 2007 buses will not require retrofits since these school buses will meet EPA's new emissions standards, but any factory-installed particle filter will most likely have some associated maintenance costs.

Some school bus fleet managers have expressed concerns regarding the operational characteristics and maintenance costs associated with diesel particle filters. For this reason, the program should assume that some model year 2001-2006 buses may be retrofitted with high-performance diesel oxidation catalysts in lieu of diesel particle filters. An optional scenario assumes retrofitting model year 2000-2006 school buses with 50 percent high-performance diesel oxidation catalysts and 50 percent diesel particle filters. All of these buses would also be retrofitted with closed crankcase ventilation filters. The cost to retrofit this optional scenario

would be $15,116,000. Under this scenario annual maintenance cost for 1,250 school buses retrofitted with particle filters is expected to average $375,000.

Total retrofit costs: model year 1982 and newer:

The cost to retrofit model years 1982-2000 school buses is anticipated to range from $28,947,000 to $35,817,000. This amount does not include administrative or cleaner fuel expenses. These retrofit costs also do not take into account maintenance costs for particle filters, or the cost to retrofit private, or contracted, pupil transportation services that own and operate approximately 1000 school buses in the Everett, Seattle, Spokane, and Tacoma areas. The following table, Scenario 1, summarizes these total costs by grouped model years, based upon the appropriate type of retrofit technology. An alternative retrofit strategy, Scenario 2, is also presented below.

**Cost to Retrofit the Washington State Public School Bus Fleet:**
**Contains Type B, C, and D Buses; Excludes Type A Vans**

**Scenario 1**

| Technology Type | Model Year Group | Number of Buses* | Total Costs** |
|---|---|---|---|
| None | 1981- | 552 | $0 |
| DOC | 1982-1987 | 957 | $1,273,000 |
| DOC + OCV | 1988-1994 | 2708 | $5,107,000 |
| HP-DOC + OCV/CCV | 1995-2000 | 2332 | $10,479,000 |
| DPF + CCV | 2001-2006 | 2500 | $18,958,000 |
| Total | | * | $35,817,000 |

Scenario 2

| Technology Type | Model Year Group | Number of Buses | Total Costs** |
|---|---|---|---|
| None | 1981- | 552 | $0 |
| DOC | 1982-1987 | 957 | $1,273,000 |
| DOC + OCV | 1988-1994 | 2708 | $5,107,000 |
| 50% DOC + OCV/CCV<br>50% HP-DOC + OCV/CCV | 1995-2000 | 2332 | $7,451,000 |
| 50% HP-DOC + /CCV<br>50% DPF + CCV | 2001-2006 | 2500 | $15,116,000 |
| Total | | * | $28,947,000 |

DOC = Diesel Oxidation Catalysts
OCV = Open Crankcase Ventilation Filter
CCV = Closed Crankcase Ventilation Filter
HP-DOC = High Performance Diesel Oxidation Catalysts
OCV/CCV = OCV or CCV
DPF = Diesel Particle Filter
*Total number eligible for retrofit equals 8497 buses.
** Does not include any maintenance costs that may be associated with particle filters.

Private student transportation services:

Private, or contracted, student transportation services in the Everett, Seattle, Spokane, and Tacoma areas own and operate approximately 1,000 buses, mostly model years 2000 and newer, so that most of these buses will qualify for particle filters. In general, managers for these private fleets are comfortable with the state retrofitting their school buses with particle filters. Retrofitting these buses with particle filters and closed crankcase ventilation filters will most likely cost a minimum of $7,600,000, with an expected annual maintenance cost of $300,000.

Cleaner fuel, cleaner fuel infrastructure projects, and other projects that reduce diesel emissions:

The program proposes to complete ten cleaner fuels or cleaner fuel infrastructure projects over five years. Funding for cleaner fuel and other projects that reduce diesel emissions must come out of the 15 percent flexible portion of the allocated funds. To date, this includes funding the cost differential for ultra-low sulfur diesel (ULSD) or diesel blended with biodiesel, B20. The annual cost for these projects might range from a few thousand dollars per project, to a few tens of thousands of dollars per project. In 2006, federal law will require refiners to produce ULSD fuel, so that the funding of any cost differential will cease. In addition, the 2004 Congress passed a twenty cent per gallon tax credit for B20. As a result, the cost differential for B20 should be reduced to five to ten cents per gallon when compared to current on-road diesel fuel, and to only a few cents per gallon when compared to ULSD. The total costs for cleaner fuel or other projects that reduce diesel emissions cannot exceed $750,000 per year (15 percent of $5 million), or $3,750,000 over five years (15 percent of $25 million).

Administrative Costs:

Administrative costs for the five-quarter period July 1, 2003 through September 30, 2004 were $128,595. Annual administrative costs are expected to remain reasonably constant at an amount of $103,000, for a total of $515,000 over five years.

Total Costs:

Based upon the strategies identified in this report, the five-year cost to retrofit both the public and private school bus fleet is anticipated to cost between $40,812,000 and $47,682,000, exceeding the state's five year allotment of $25,000,000 by $15,812,000 to $22,682,000. An additional annual maintenance cost for school buses retrofitted with particle filters is expected to range from $675,000 to $1,050,000. These filter maintenance costs might be best managed by a one-time purchase of regional filter cleaning stations for school districts.

Estimated Costs to Retrofit All School Buses in Washington State:

Scenario 1

| Retrofit Public Fleet | Retrofit Private Fleet | Clean Fuels/ Other Projects | Admin. | Total Cost | Revenue | Shortfall |
|---|---|---|---|---|---|---|
| $35,817,000 | $7,600,000 | $3,750,000 | $515,000 | $47,682,000 | $25,000,000 | $22,682,000 |

Scenario 2

| Retrofit Public Fleet | Retrofit Private Fleet | Clean Fuels/ Other Projects | Admin. | Total Cost | Revenue | Shortfall |
|---|---|---|---|---|---|---|
| $28,947,000 | $7,600,000 | $3,750,000 | $515,000 | $40,812,000 | $25,000,000 | $15,812,000 |

Cost vs. revenue assessment:

The Department of Ecology and local air quality agencies, along with industry retrofit experts, have coordinated a state retrofit strategy to insure that retrofit technologies are appropriately applied to the state's school bus fleet. The following points are noteworthy:

- The age of school buses in the public fleet is not uniform across the state. Smaller rural school districts tend to have a greater quantity of older buses than larger urban school districts.
- Retrofitting older, late model school buses with diesel oxidation catalysts reduces three to five times more emissions per school bus, than retrofitting newer school buses with diesel particle filters.
- Diesel oxidation catalysts are maintenance free, while diesel particle filters have associated maintenance costs.
- Retrofitting a newer school bus with a diesel particle filter costs three to four times more than retrofitting an older school bus with a diesel oxidation catalyst, but a particle filter is three to four times more effective than an oxidation catalysts.
- For the selected technologies, newer school buses can be retrofitted with diesel oxidation catalysts, either ceramic or wire mesh substrates, or with diesel particle filters.

Since each local air quality agency is responsible for independently managing their jurisdictions budgets, two scenarios may evolve:

- A local air agency whose jurisdiction contains hundreds of newer school buses, and which elects to retrofit those school buses with diesel particle filters, will have a shortfall of state retrofit funds.
- A local air agency whose jurisdiction contains aging school bus fleets may have a surplus of funding.

Each air quality agency will need to decide how to manage potential budget shortfalls. The program will explore and assess the feasibility of the following options:

- Increase efforts to leverage federal grant funds with existing state funds.
- Apply less-expensive technology to model year 2001 and newer buses.
- Seek additional supplementary state funds or extend current funding beyond five years.

# Appendices

## *Appendix A: Engrossed Substitute Senate Bill 6072*

Secretary of State

State of Washington

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ENGROSSED SUBSTITUTE SENATE BILL 6072

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Passed Legislature - 2003 Regular Session

State of Washington 58th Legislature 2003 Regular Session

By Senate Committee on Highways & Transportation (originally sponsored by Senators Horn and Haugen)

READ FIRST TIME 04/11/03.

AN ACT Relating to funding pollution abatement and response; amending RCW 46.12.040, 46.12.101, and 46.68.020; adding a new section to chapter 70.94 RCW; adding a new section to chapter 90.56 RCW; creating a new section; making appropriations; and providing an expiration date.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

{+ NEW SECTION. +} Sec. 1. A new section is added to chapter 70.94 RCW to read as follows:

(1) Money deposited in the segregated subaccount of the air pollution control account under RCW 46.68.020(2) shall be distributed as follows:

(a) Eighty-five percent shall be distributed to air pollution control authorities created under this chapter. The money must be distributed in direct proportion with the amount of fees imposed under RCW 46.12.080, 46.12.170, and 46.12.181 that are collected within the boundaries of each authority. However, an amount in direct proportion with those fees collected in counties for which no air pollution control authority exists must be distributed to the department.

(b) The remaining fifteen percent shall be distributed to the department.

(2) Money distributed to air pollution control authorities and the department under subsection (1) of this section must be used as follows:

(a) Eighty-five percent of the money received by an air pollution control authority or the department must be used to retrofit school buses with exhaust emission control devices or to provide funding for fueling infrastructure necessary to allow school bus fleets to use alternative,

cleaner fuels.

(b) The remaining fifteen percent may be used by the air pollution control authority or department to reduce vehicle air contaminant emissions and clean up air pollution, or reduce and monitor toxic air contaminants.

(3) Money in the air pollution control account may be spent by the department only after appropriation.

(4) The department shall provide a report to the legislative transportation committees on the progress of the implementation of this section by December 31, 2004.

{+ NEW SECTION. +} Sec. 2. The sum of ten million dollars is appropriated for the biennium ending June 30, 2005, from the segregated subaccount of the air pollution control account to the department of ecology for the purposes of section 1 of this act.

{+ NEW SECTION. +} Sec. 3. A new section is added to chapter 90.56 RCW to read as follows:

The vessel response account is created in the state treasury. Grants, gifts, and federal funds may be deposited into the account. Oil spill penalties assessed against ships under RCW 90.56.330 and 90.48.144 shall also be deposited into the account as well as the money distributed under RCW 46.68.020(2). Moneys in the account may be spent only after appropriation. The department of ecology is authorized to utilize the vessel response account to preposition a dedicated rescue tug at the entrance to the Strait of Juan de Fuca to reduce the risk of major maritime accidents and oil spills on the outer coast and western strait. Prior to authorizing the rescue tug to respond to a distressed vessel, the department shall work with the United States Coast Guard and industry to determine if another capable, unencumbered commercial tug is available in the area that can respond. If such a tug can respond without increasing the risk of a casualty, it should be deployed as the tug of choice and the state-contracted rescue tug should not be taken off standby duty. The department is also authorized to spot charter tugs as needed during major storms and other high risk periods to protect maritime commerce and the environment anywhere in state waters.

The department shall not proceed with rule making related to emergency towing pursuant to chapter 88.46 RCW, so long as the deposit of the fee into the vessel response account under RCW 46.68.020(2) is continued and is appropriated for the purpose of the dedicated rescue tug.

{+ NEW SECTION. +} Sec. 4. The department of ecology shall complete an evaluation of tug escort requirements for laden tankers to determine if the current escort system requirements under RCW 88.16.190 should be modified to recognize safety enhancements of the new double hull tankers deployed with redundant systems. The department shall provide a report with recommendations to the governor and the appropriate committees of the legislature by January 1, 2005.

{+ NEW SECTION. +} Sec. 5. (1) The sum of two million eight hundred seventy-six thousand dollars is appropriated for the biennium ending June 30, 2005, from the vessel response account to the department of ecology for the purposes of section 3 of this act.

(2) The sum of two hundred thousand dollars is appropriated for the biennium ending June 30, 2005, from the oil spill prevention account to the department of ecology for the purposes of section 4 of this act.

Sec. 6. RCW 46.12.040 and 2002 c 352 s 3 are each amended to read as follows:

{+ (1) +} The application accompanied by a draft, money order, certified bank check, or cash for five dollars, together with the last preceding certificates or other satisfactory evidence of ownership, shall be forwarded to the director.

{+ (2) +} The fee shall be in addition to any other fee for the license registration of the vehicle. The certificate of ownership shall not be required to be renewed annually, or at any other time, except as by law provided.

{+ (3) +} In addition to the application fee and any other fee for the license registration of a vehicle, the department shall collect from the applicant a fee of fifteen dollars for vehicles previously registered in any other state or country. (({- The proceeds from the fee shall be deposited in the motor vehicle fund. For vehicles requiring a physical examination, the inspection fee shall be fifty dollars and shall be deposited in the motor vehicle fund. -}))

Sec. 7. RCW 46.12.101 and 2002 c 279 s 1 are each amended to read as follows:

A transfer of ownership in a motor vehicle is perfected by compliance with the requirements of this section.

(1) If an owner transfers his or her interest in a vehicle, other than by the creation, deletion, or change of a security interest, the owner shall, at the time of the delivery of the vehicle, execute an assignment to the transferee and provide an odometer disclosure statement under RCW 46.12.124 on the certificate of ownership or as the department otherwise prescribes, and cause the certificate and assignment to be transmitted to the transferee. The owner shall notify the department or its agents or subagents, in writing, on the appropriate form, of the date of the sale or transfer, the name and address of the owner and of the transferee, the transferee's driver's license number if available, and such description of the vehicle, including the vehicle identification number, the license plate number, or both, as may be required in the appropriate form provided or approved for that purpose by the department. The report of sale will be deemed properly filed if all information required in this section is provided on the form and includes a department-authorized notation that the document was received by the

department, its agents, or subagents on or before the fifth day after the sale of the vehicle, excluding Saturdays, Sundays, and state and federal holidays. Agents and subagents shall immediately electronically transmit the seller's report of sale to the department. Reports of sale processed and recorded by the department's agents or subagents may be subject to fees as specified in RCW 46.01.140 (4)(a) or (5)(b). By January 1, 2003, the department shall create a system enabling the seller of a vehicle to transmit the report of sale electronically. The system created by the department must immediately indicate on the department's vehicle record that a seller's report of sale has been filed.

(2) The requirements of subsection (1) of this section to provide an odometer disclosure statement apply to the transfer of vehicles held for lease when transferred to a lessee and then to the lessor at the end of the leasehold and to vehicles held in a fleet when transferred to a purchaser.

(3) Except as provided in RCW 46.70.122 the transferee shall within fifteen days after delivery to the transferee of the vehicle, execute the application for a new certificate of ownership in the same space provided therefor on the certificate or as the department prescribes, and cause the certificates and application to be transmitted to the department.

(4) Upon request of the owner or transferee, a secured party in possession of the certificate of ownership shall, unless the transfer was a breach of its security agreement, either deliver the certificate to the transferee for transmission to the department or, when the secured party receives the owner's assignment from the transferee, it shall transmit the transferee's application for a new certificate, the existing certificate, and the required fee to the department. Compliance with this section does not affect the rights of the secured party.

(5) If a security interest is reserved or created at the time of the transfer, the certificate of ownership shall be retained by or delivered to the person who becomes the secured party, and the parties shall comply with the provisions of RCW 46.12.170.

(6) If the purchaser or transferee fails or neglects to make application to transfer the certificate of ownership and license registration within fifteen days after the date of delivery of the vehicle, he or she shall on making application for transfer be assessed a twenty-five dollar penalty on the sixteenth day and two dollars additional for each day thereafter, but not to exceed one hundred dollars. The director may by rule establish conditions under which the penalty will not be assessed when an application for transfer is delayed for reasons beyond the control of the purchaser. Conditions for not assessing the penalty may be established for but not limited to delays caused by:

(a) The department requesting additional supporting documents;

(b) Extended hospitalization or illness of the purchaser;

(c) Failure of a legal owner to release his or her interest;

(d) Failure, negligence, or nonperformance of the department, auditor, or subagent.

Failure or neglect to make application to transfer the certificate of ownership and license registration within forty-five days after the date of delivery of the vehicle is a misdemeanor.

(7) Upon receipt of an application for reissue or replacement of a certificate of ownership and transfer of license registration, accompanied by the endorsed certificate of ownership or other documentary evidence as is deemed necessary, the department shall, if the application is in order and if all provisions relating to the certificate of ownership and license registration have been complied with, issue new certificates of title and license registration as in the case of an original issue and shall transmit the fees together with an itemized detailed report to the state treasurer(({- , to be deposited in the motor vehicle fund -})).

(8) Once each quarter the department shall report to the department of revenue a list of those vehicles for which a seller's report has been received but no transfer of title has taken place.

Sec. 8. RCW 46.68.020 and 2002 c 352 s 21 are each amended to read as follows:

The director shall forward all fees for certificates of ownership or other moneys accruing under the provisions of chapter 46.12 RCW to the state treasurer, together with a proper identifying detailed report. The state treasurer shall credit such moneys (({- to the multimodal transportation account in RCW 47.66.070, and all expenses incurred in carrying out the provisions of that chapter shall be paid from such account as authorized by legislative appropriation -})) {+ as follows:

(1) The fees collected under RCW 46.12.040(1) shall be credited to the multimodal transportation account in RCW 47.66.070.

(2)(a) Beginning with the effective date of this section, and until +} {+ July 1, 2008, the fees collected under RCW 46.12.080, 46.12.170, and 46.12.181 shall be credited as follows:

(i) 58.12 percent shall be credited to a segregated subaccount of the air pollution control account in RCW 70.94.015;

(ii) 15.71 percent shall be credited to the vessel response account created in section 3 of this act; and

(iii) The remainder shall be credited into the transportation 2003 account (nickel account).

(b) Beginning July 1, 2008, and thereafter, the fees collected under RCW 46.12.080, 46.12.170, and 46.12.181 shall be credited to the transportation 2003 account (nickel account).

(3) All other fees under chapter 46.12 RCW shall be credited to the motor vehicle account, unless specified otherwise +}.

{+ NEW SECTION. +} Sec. 9. Sections 1 and 3 of this act expire July 1, 2008.

--- END ---

## *Appendix B: Retrofit Strategies*

### Program Development

Manufacturers of emission control equipment continually develop and market new and improved retrofit technologies that reduce harmful toxic emissions and fine particles from existing diesel engines. As with all developing technologies, the cost and features vary considerably, depending upon the desired performance of the technology. New retrofit technology may provide greater emissions reduction, but often costs more and is not time-tested in the field. The performance of older, field-tested technologies is better understood, yet often provides lesser emissions reductions. Deciding whether to use currently available technology, or wait for more advanced technology, is one of the primary challenges that users of retrofit technology must address.

The "Washington State Clean School Bus Program" technical workgroup provides a combined experience that exceeds forty years for solving air quality problems caused by diesel powered vehicles. In order to make the best decisions possible for selecting the appropriate retrofit technology, the technical workgroup regularly consults with industry retrofit experts and end users. To insure that the retrofit emissions control equipment used by this program meets the manufacturer's claims and specifications, the Washington Clean School Bus Program uses only EPA verified technology.

Competitive prices and quality services are guaranteed by a state contract managed by the State's Office of Financial Management. Through a competitive bid, the State awarded a one year contract to Cummins Northwest to install diesel oxidation catalysts manufactured by Fleetguard Emissions Solutions, a Cummins' subsidiary. Local air quality agencies have also awarded additional installation contracts for individual school districts to other local contractors.

For diesel powered school buses, after combustion control equipment must be appropriately matched to the type, size, age, and use of the diesel engine. No single technology can be universally applied to all school buses. Some technologies require use of cleaner fuels, such as ultra-low sulfur diesel. Failure to apply the appropriate technology, or use the appropriate fuel, can result in reduced performance or even failure of the retrofit equipment, or power loss and decreased fuel efficiency of the engine.

### Criteria for Selecting Emissions Control Technology

The appropriate technology should:

- be field tested, time proven, and provide verifiable emissions benefits;
- target reducing toxic pollutants and fine particulates;
- not inhibit engine performance;
- require reasonable, or no maintenance;
- not create unreasonable burdens upon fleet managers during installation;
- provide cost-effective emissions benefits;
- when possible, provide emissions benefits equivalent or nearly equivalent to meeting EPA's emissions standards for model year 2007 heavy-duty diesel vehicles.

**School Bus Emissions Standards**

The appropriate selection of retrofit emissions control equipment is highly dependent upon the useful life of the diesel engine, which may be some combination of model years for the chassis, engine, and body. Retrofit technology is primarily matched to engine design and the associated engine technology. Unlike urban transit buses, EPA does not set independent emissions standards for school buses. School bus emission standards are included in the emissions standards for heavy-duty diesel vehicles, with older model years having less stringent emissions standards. Diesel powered buses manufactured prior to 1988 emit more than ten times the amount of fine particles than a model year 1994 and newer bus, and more than 100 times the 2007 model year standards. EPA's 2007 standards for heavy-duty diesel vehicles are considered the gold standard for limiting toxic emissions and fine particles.

**Model Year Breakdown for EPA Emissions Standards (g/bhp-hr*):**
**Heavy-Duty Highway Compression Engines (1985-2007+)**

| Model Year | Carbon Monoxide | Hydrocarbons | Nitrogen Oxides | Particulate Matter |
|---|---|---|---|---|
| 1985-1987 | 15.5 | 1.3 | 6.0 | 1.0 |
| 1988-1990 | 15.5 | 1.3 | 6.0 | 0.6 |
| 1991-1993 | 15.5 | 1.3 | 5.0 | 0.25 |
| 1994-1997 | 15.5 | 1.3 | 5.0 | 0.1 |
| 1998-2003 | 15.5 | 1.3 | 4.0 | 0.1 |
| 2004-2006 | 15.5 | 0.5 | 2.0 | 0.1 |
| 2007+ | 15.5 | 0.15 | 0.2 | 0.01 |

*g/bhp-hr = grams per brake-horsepower hour

**Retrofit Technologies and Cleaner Fuels**

Based upon the criteria for appropriate technology, three types of emissions control equipment have been selected for the Washington school bus fleet: diesel oxidation catalysts (DOCs), crankcase ventilation filters (open crankcase ventilation - OCV, or closed crankcase ventilation - CCV), and diesel particle filters (DPFs). Crankcase ventilation filters will be installed in combination with either a DOC or DPF.

The following table presents selected retrofit technologies by model years. In general, this breakout holds true for the majority of retrofits, although some technology overlap may occur between selected model year bins. For example, some model year 2000 buses have been retrofitted with DPF technology, while other model year 2001 buses have required a DOC rather than a DPF.

**Selected Retrofit Technologies by Model Years**

| Model Years | Number of Buses | DOC (ceramic substrate) | DOC (wire mesh substrate) | OCV/CCV Filter | DPF |
|---|---|---|---|---|---|
| 1981- | 522 | No | No | No | No |
| 1982-1987 | 957 | Yes | No | No | No |
| 1988-1994 | 2708 | Yes | Maybe | Yes | No |
| 1995-2000 | 2332 | Yes | Yes | Yes | No |
| 2001-2005 | 1671 | Yes | Yes | Yes | Yes |

Diesel Oxidation Catalysts

Since model year 1994 and older school buses emit ten times more harmful pollutants than model year 1995 and newer buses, the first year of the Washington program focused on retrofitting these older, more polluting buses with diesel oxidation catalysts or DOCs. A DOC consists of an off-the-shelf, ceramic substrate that is custom fitted in an installation kit designed for a specific school bus chassis and engine configuration. According to the manufacturer's specifications, the Fleetguard Emissions Solutions DOC provided under the state contract reduces 25% or more of the fine particulates, 70% or more of the hydrocarbons, and 70% or more of the carbon monoxide from the tailpipe emissions. Total toxic emissions are reduced by approximately 50%. DOCs are maintenance free and the average cost under the state contract is $920 for the retrofit kit, and $300 for installation. The average DOC cost for the second year of the contract is slightly less than the first year, $1182 for parts and installation for the Fleetguard product.

Diesel Oxidation Catalysts/Crankcase Ventilation Filter Packages

Crankcase ventilation filters eliminate crankcase emissions that include unburned fuel, blow-by gases, toxic hydrocarbon gases, and engine oil contaminants. Crankcase ventilation filters (CCVs) can reduce fine particulate emissions by an additional 10-12%. The filters also reduce engine oil consumption, and under-hood odors and fumes that may be transmitted into the cab by way of the heater ventilation system. Crankcase ventilation filters may be installed on model year 1988 and newer school buses.

The Puget Sound Clean Air Agency and the Spokane Clean Air Authority awarded individual contracts to pilot closed crankcase ventilation filters combined with DOCs at the Lake Washington and Mead school districts, respectively. At the time of the award, only the Donaldson Corporation provided EPA verified CCV filters. The cost for parts and installation of the Donaldson DOC/CCV package is approximately $2100 per bus. The Donaldson CCV filters must be changed on a regular maintenance schedule, normally coinciding with oil and oil filter servicing.

Fleetguard Emissions Solutions (FES) is currently pursuing EPA verification for both an open crankcase (OCV) and a closed crankcase ventilation filter. The OCV filter is designed to be

installed on model year 1988-1998 school buses, eliminating 70% of the aerosol emissions and 98% of the oil drip. The CCV filter is to be installed on model year 1999 and newer buses, eliminating 100% of the aerosol exhaust and 100% of the oil drip. As of 1999, manufactures began using anti-corrosive materials in the intake manifold design. The Fleetguard OCV filter is specifically designed to be installed on those engines that do not have intake manifolds manufactured from anti-corrosive materials. The Fleetguard OCV filter costs $512 ($257 parts and $255 labor), and the CCV filter costs $537 ($267 parts and $270) labor. Fleetguard's OCV and CCV filters provide an added benefit, in that neither type requires maintenance. The average cost for the Fleetguard DOC/CCV package is $1719 per school bus.

High-Performance Diesel Oxidation Catalysts

Year two of the state contract will provide an option to install a diesel oxidation catalyst with a wire mesh substrate that reduces greater than 50% of the tailpipe fine particle; these devices are referred to as "high-performance DOCs." In order to qualify for a high-performance DOC, the school bus temperature exhaust must reach 300 degrees Celsius for 15% of the duty cycle. Most buses belonging to model years 1995 to 2000 should qualify for the high-performance DOC. The cost of the high performance DOC is $3620: $3170 for parts and $450 for labor. The high-performance DOC can reduce twice the amount of particulates as the standard DOC. The cost of the high-performance DOC is three times greater than the standard DOC, so the installation of high-performance DOC will be targeted for buses that are likely to be retained for ten to twenty more years.

Cummins Northwest has installed data logging equipment to monitor the exhaust temperatures on a variety of school bus types and model years. This data will be used to develop exhaust temperature profiles for these buses and determine which types of buses qualify for the high-performance DOC. This evaluation is scheduled to be completed by mid-December, so that the first orders for high-performance DOC might be placed early in 2006.

Diesel Particle Filters (DPF)

Individual school bus qualifications for a DPF include technical specs, such as electronic fuel injectors and adequate exhaust temperature profiles, plus a dedicated supply of ultra-low sulfur diesel fuel. In order for a vehicle to qualify to be retrofitted with a particle filter, a temperature profile for the vehicle exhaust must be data logged to insure that the exhaust temperatures meet the minimum specifications for a particle filter. Most particle filters also require the use of ultra-low sulfur diesel fuel. Failure to meet the above criteria will cause the particle filter to clog. Particle filters also require routine maintenance in which the filters must be periodically cleaned.

King County Metro has successfully retrofitted their transit fleet with particle filters. However, a previous school bus retrofit effort, prior to development of the Washington State School Bus Program, resulted in clogged filters on a group of model year 1990-1993 buses serving the Everett School District. For this reason, the Program has elected to pilot particle filter retrofit projects at selected school districts. The Puget Sound Clean Air Agency is currently piloting installation of particle filters on selected model year 2000 and newer school buses that will be closely monitored to insure that the filters perform as designed.

Once the technical workgroup is confident that contractors can successfully retrofit school bus engines with particle filters, the Program will pursue developing a state contract to retrofit model years 2001 and newer buses with particle filters. Most likely, model years 2000 and older will not have the appropriate engine technology to be suitable candidates for particle filters. Particle filters can reduce fine particles by up to 90% so that emissions might be reduced sufficiently to meet EPA's 2007 emissions standards. The cost of particle filters ranges widely between $6000 and $17000.

Particle filters need to be periodically cleaned, with the period varying from once per year to possibly several times a year. Particle filter maintenance depends on the vehicle and filter type, and the vehicle operation. At a minimum, most filters require an annual flushing in which a filter cleaning station forces compressed air through the filter to remove trapped particles. The cost for this forced air cleaning is about $100 per flushing. Most likely, particle filters will need a regenerative cleaning every one to two years. The regenerative cleaning combines heat with forced air to bake and flush particles from the filter, restoring the filter to a like new state. This regenerative process costs about $500 per cleaning. While the cost of filter cleaning may range from $100 to $700 per year, filter maintenance should average about $600 every two years. Long-term filter maintenance cost could be significantly reduced by purchasing filter cleaning stations at a cost of about $17,000 per station. The Program will explore establishing cooperative sites in which several school districts might share a single filter cleaning station.

Ultra-low Sulfur Diesel (ULSD)

EPA's current on-road diesel fuel requirements limit the maximum sulfur content to 500 parts per million (ppm). Beginning July 15, 2006, refiners must limit the maximum sulfur content to 15-ppm. For reducing diesel emissions, ultra-low sulfur diesel or ULSD, provides dual benefits. Substituting ULSD for standard on-road diesel reduces fine particle emissions by 5% to 9%, depending on the sulfur content of the available on-road diesel fuel and engine design. Advanced retrofit technologies such as particle filters require the use of ULSD, since sulfur in the fuel contributes to early clogging of the filters. At a cost differential of about five cents per gallon more than conventional on-road diesel, ULSD is available to school districts in the Central Puget Sound area.

Biodiesel and Clean Fuels

Biodiesel is a fuel that is produced from either vegetable oils or animal fats and meets the standard specification for use as a blend stock for distillate fuel oil. Ecology elected to use funding provided by ESSB 6072 to fund HB1243. This bill required a pilot program to use a 20% biodiesel blend (B20) at the Central Valley School District in Spokane WA for the 2003-2004 school year, and the North Shore School District for the 2004-2005 school year. Ecology also elected to continue funding the cost differential of B20 at the Central Valley School District for the 2004-2005 school year. B20 costs approximately twenty cents per gallon more than standard on-road diesel, but reduces fine particle emissions by 10% or more. Recently passed federal legislation could reduce the price of B20 to a cost that is competitive to ULSD, which could make a ULSD/B20 mix the gold standard for school buses.

ESSB 6072 also recognized the emission benefits that other clean fuels, such as compressed natural gas (CNG), may provide. Although no projects were funded in the first year of Program operations, some school districts may consider alternate clean fuel programs in the ensuing years.

**Retrofit Strategy**

Based upon appropriately matching retrofit technology, the general strategy is described below. In general, this breakout holds true for the majority of retrofits, although some technology overlap may occur between selected model year bins. For example, some model year 2000 buses have been retrofitted with DPF technology, while other model year 2001 buses have required a DOC rather than a DPF.

- Model year 1981 and older buses are too old to qualify for retrofit technology (unless they've had their engines replaced).
- Retrofit model years 1982-1987 with diesel oxidation catalysts (ceramic substrates), provided they will be on the road for at least three years;
- Retrofit model years 1988-1994 with diesel oxidation catalysts (ceramic substrates) and crankcase ventilation filters resulting in a 40% reduction in fine particles, provided they will be on the road for at least three years;
- Retrofit model years 1995-2000 with high-performance diesel oxidation catalysts (wire mesh substrates) and crankcase ventilation filters resulting in a 60% reduction in fine particles (Some school districts began retrofitting model year 1995-2000 with DOC with ceramic substrates prior to the availability of wire mesh substrates.);
- Retrofit model year 2001 and newer school buses with diesel particle filters and crankcase ventilation filters resulting in a 90% reduction in fine particles (Some school districts may elect to retrofit school buses with DOC rather than a DPF.);

Once ultra-low sulfur diesel become readily available, those buses retrofitted with standard and high-performance diesel oxidation catalysts and crankcase ventilation filters will respectively achieve a 50% and 70% reduction in fine particles. Adding a 20% blend of biodiesel would provide additional fine particle reductions.

**Retrofit Schedule:**

Year One:

- As of September 30, 2004, the program retrofitted more than 1221 school buses. During the writing of this report, air quality agencies retrofitted another 530 buses and received bulk orders for an additional 900 retrofit kits.
- As of May 1, 2004, the program implemented two pilot projects to test more advanced technologies and two projects to test alternative fuels.
- As of June 1, 2004, the program developed and implemented a state-wide, school bus emission maintenance program.

Year Two:

- Pilot additional retrofit projects with more advanced technologies.
- Complete retrofits on model years 2000 and older.

Year Three:

- Transition to most advanced technology for model year 2001 and newer buses.

Year Four:

- Retrofit all remaining school buses to achieve 90% penetration.

Year Five:

- Retrofit all remaining school buses, subject to available funds.

## *Appendix C: Retrofit Process*

The Department of Ecology and local air authorities have developed a process that: 1) obtains the best price possible through volume purchasing, 2) minimizes any burden on school districts, and 3) guarantees quality control and quality assurance through local management. Ecology and the state's Office of Financial Management manage the state contract, while local air authorities manage the actual retrofit process. Each quarter of the fiscal year, Ecology distributes funds to local air authorities. Local air authorities manage their individual budgets and insure that each school district receives the highest level possible of customer service. Ecology utilizes a centralized tracking system, in which local air authorities report quarterly.

Our customer service goal is 100 percent customer satisfaction. We meet this goal by providing a turn-key operation that works around a school district's busy schedule. Our state contractor installs retrofit kits on-site during those periods when school buses are not in service, which includes weekends and school vacation periods. Our contractors install the retrofit kits in ninety minutes or less, so that two installers can retrofit eight to ten buses per day for a school district. Although 99 percent of the school districts elect to use our state contracted installers, school districts may elect to have their own mechanic perform the installations. The second year of the program will explore expanding retrofits during evening hours.

The process is as follows:

1. School district contacts local air authority or the Department of Ecology.
2. School district provides makeup of school bus fleet.
3. Cummins Northwest (CNW) service branch representative makes appointment to visit the school district to survey the school bus fleet.
4. CNW representative determines the exact retrofit kit for the engine and chassis configuration, and completes a quick maintenance check to insure that the bus does not burn excess oil, which might foul the retrofit technology.
5. CNW forwards the school bus survey to local air quality agency. The survey identifies the retrofit kit and purchase price.
6. Local air quality agency reviews survey and issues purchase order for retrofit kits to CNW branch.
7. CNW branch forwards orders to CNW headquarters.
8. CNW HQ places quarterly bulk order to Fleetguard Emissions Solutions (FES).
9. FES manufactures retrofit kits and ships kits to CNW's Portland distribution center.
10. CNW's Portland distribution center forwards retrofit kits to CNW branch service centers.
11. CNW branch service centers make appointment with school districts to install retrofit kits.
12. CNW installs retrofit kits and invoices local air quality agency.
13. Local air quality agency pays CNW for retrofits.
14. Local air quality agency or school district inspects to confirm that installations are satisfactory.

## *Appendix D: First Year Results by School District*

| School District | County | Number of Buses | Number of Buses Retrofitted |
|---|---|---|---|
| Asotin-Anatone | Asotin | 11 | 3 |
| Auburn | King | 115 | 72 |
| Bainbridge Island | Kitsap | 31 | 10 |
| Bellevue | King | 94 | 27 |
| Bellingham | Whatcom | 8 | 5 |
| Bremerton | Kitsap | 33 | 12 |
| Brinnon | Jefferson | 3 | 3 |
| Camas | Clark | 55 | 10 |
| Cape Flattery | Clallam | 10 | 4 |
| Cashmere | Chelan | 12 | 1 |
| Centerville | Klickitat | 5 | 2 |
| Centralia | Lewis | 44 | 14 |
| Chehalis | Lewis | 25 | 10 |
| Cheney | Spokane | 48 | 20 |
| Chimacum | Jefferson | 16 | 6 |
| Colfax | Whitman | 19 | 6 |
| Coupeville | Island | 6 | 5 |
| Crescent | Clallam | 5 | 5 |
| Dayton | Columbia | 26 | 3 |
| East Valley | Spokane | 34 | 19 |
| East Valley | Yakima | 23 | 10 |
| Edmonds | Snohomish | 141 | 70 |
| Ellensburg | Kittitas | 34 | 3 |
| Elma | Gray's Harbor | 23 | 9 |
| Endicott | Whitman | 10 | 2 |
| Ephrata | Grant | 25 | 7 |
| Evergreen | Clark | 234 | 64 |
| Federal Way | King | 134 | 24 |
| Finley | Benton | 15 | 7 |
| Glenwood | Klickitat | 4 | 2 |
| Goldendale | Klickitat | 16 | 4 |
| Grandview | Yakima | 10 | 2 |
| Granger | Yakima | 10 | 1 |
| Grapeview | Mason | 3 | 2 |
| Griffin | Thurston | 18 | 3 |
| Highland | Yakima | 12 | 0 |
| Highline | King | 101 | 14 |
| Hood Canal | Mason | 10 | 1 |
| Issaquah | King | 120 | 31 |
| Kennewick | Benton | 89 | 50 |
| Kent | King | 126 | 66 |
| Kiona-Benton City | Benton | 21 | 10 |
| Klickitat | Klickitat | 5 | 1 |
| La Conner | Skagit | 1 | 1 |
| Lake Chelan | Chelan | 21 | 4 |
| Lake Washington | King | 141 | 30 |
| Lind | Adams | 9 | 4 |

| School District | County | Number of Buses | Number of Buses Retrofitted |
|---|---|---|---|
| Longview | Cowlitz | 57 | 6 |
| Lyle | Klickitat | 8 | 1 |
| Mabton | Yakima | 4 | 1 |
| Mansfield | Douglas | 7 | 1 |
| Manson | Chelan | 13 | 2 |
| Mary Knight | Mason | 6 | 4 |
| Medical Lake | Spokane | 25 | 12 |
| Mercer Island | King | 40 | 12 |
| Monroe | Snohomish | 58 | 9 |
| Mrt. Adams | Yakima | 11 | 0 |
| Mt. Vernon | Skagit | 13 | 2 |
| Naches Valley | Yakima | 19 | 8 |
| Naselle | Pacific | 9 | 5 |
| North Kitsap | Kitsap | 75 | 28 |
| North Thurston | Thurston | 103 | 15 |
| Northshore | King | 133 | 29 |
| Oak Harbor | Island | 9 | 9 |
| Ocean Beach | Pacific | 25 | 13 |
| Ocosta | Gray's Harbor | 12 | 1 |
| Olympia | Thurston | 71 | 35 |
| Orondo | Douglas | 7 | 1 |
| Oroville | Okanagan | 14 | 13 |
| Pasco | Franklin | 92 | 28 |
| Pioneer | Mason | 13 | 7 |
| Port Angeles | Clallam | 39 | 19 |
| Port Townsend | Jefferson | 13 | 4 |
| Posser | Benton | 45 | 11 |
| Queets | Jefferson | 2 | 1 |
| Quilcene | Jefferson | 6 | 3 |
| Quillayute Valley | Clallam | 20 | 7 |
| Quinault | Gray's Harbor | 9 | 4 |
| Renton | King | 85 | 14 |
| Richland | Benton | 61 | 32 |
| Ritzville | Adams | 15 | 3 |
| Seattle | King | 508 | 52 |
| Sedro-Woolley | Skagit | 22 | 2 |
| Selah | Yakima | 15 | 6 |
| Sequim | Clallam | 25 | 7 |
| Shelton | Mason | 37 | 9 |
| Snoqualmie | King | 39 | 9 |
| So. Whidbey | Skagit | 11 | 11 |
| Soap Lake | Grant | 10 | 1 |
| South Kitsap | Kitsap | 81 | 4 |
| Southside | Mason | 3 | 1 |
| Stanwood | Skagit | 14 | 12 |
| Stanwood | Snohomish | 51 | 11 |
| Steptoe | Whitman | 3 | 1 |
| Stevenson-Carson | Skamania | 12 | 4 |
| Sumner | Pierce | 76 | 14 |
| Sunnyside | Yakima | 0 | 0 |
| Tacoma | Pierce | 221 | 14 |
| Toppenish | Yakima | 16 | 4 |

| School District | County | Number of Buses | Number of Buses Retrofitted |
|---|---|---|---|
| Tumwater | Thurston | 62 | 16 |
| Union Gap | Yakima | 4 | 1 |
| Vancouver | Clark | 163 | 21 |
| Walla Walla | Walla Walla | 32 | 16 |
| Wapato | Yakima | 25 | 3 |
| Warden | Grant | 11 | 3 |
| Waterville | Douglas | 11 | 4 |
| Wenatchee | Chelan | 37 | 4 |
| West Valley | Yakima | 19 | 10 |
| White Salmon Valley | Klickitat | 20 | 2 |
| Yakima | Yakima | 48 | 18 |
| Zillah | Yakima | 9 | 2 |
| Total | | 4692 | 1273 |

## *Appendix E: Local Air Quality Agency Fiscal Reports*

Reporting Periods:

| | |
|---|---|
| 1st Quarter | 7/01/03-9/30/03 |
| 2nd Quarter | 10/01/03-12/31/03 |
| 3rd Quarter | 1/01/04-3/31/04 |
| 4th Quarter | 4/01/04-6/30/04 |
| 5th Quarter | 7/01/04-9/30/04 |
| Total | 7/01/03-9/30/04 |

Note: All balances stated represent carry forward as of 9/30/04.

Local Air Quality Agency: **Benton County Clean Air Authority**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 52,063 | 0 | 0 | 0 | 0 |
| 2nd QTR | 52,063 | 52,063 | 0 | 0 | 0 | 0 |
| 3rd QTR | 104,126 | 52,063 | 0 | 0 | 0 | 0 |
| 4th QTR | 156,189 | 52,063 | 39,270 | 0 | 9,500 | 48,770 |
| 5th QTR | 159,482 | 25,244 | 37,639 | 0 | 5,250 | 42,889 |
| Sum | $141,837 | $233,496 | $76,909 | $0 | $14,750 | $91,659 |

Balance: $141,837

Local Air Quality Agency: **Department of Ecology - Central Regional Office**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 35,511 | 0 | 1,124 | 0 | 1,124 |
| 2nd QTR | 32,387 | 35,511 | 0 | 2,511 | 0 | 2,511 |
| 3rd QTR | 63,387 | 35,511 | 0 | 3,390 | 0 | 3,390 |
| 4th QTR | 93,508 | 35,511 | 11,929 | 4,075 | 0 | 16,004 |
| 5th QTR | 111,015 | 36,701 | 38,747 | 3,161 | 0 | 41,908 |
| Sum | $105,808 | $170,745 | $50,676 | $14,261 | $0 | $64,937 |

Balance: $105,808

Local Air Quality Agency: **Department of Ecology - Eastern Regional Office**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 54,676 | 0 | 0 | 0 | 0 |
| 2nd QTR | 56,676 | 54,676 | 0 | 2,550 | 53 | 2,603 |
| 3rd QTR | 106,749 | 54,676 | 8,120 | 6,920 | 893 | 15,933 |
| 4th QTR | 145,492 | 54,676 | 54,431 | 7,263 | 444 | 62,138 |
| 5th QTR | 138,030 | 55,321 | 20,437 | 7,054 | 282 | 27,773 |
| Sum | $165,578 | $274,025 | $82,988 | $23,787 | $1,672 | $108,447 |

Balance: $165,578

Local Air Quality Agency: **Department of Ecology - Headquarters**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 187,500 | 0 | 7,441 | 0 | 7,441 |
| 2nd QTR | 180,059 | 187,500 | 0 | 7,357 | 0 | 7,357 |
| 3rd QTR | 360,202 | 187,500 | 0 | 4,464 | 6,149 | 10,613 |
| 4th QTR | 537,089 | 187,500 | 9,292 | 5,645 | 41,334 | 56,271 |
| 5th QTR | 668,318 | 171,000 | 0 | 6,557 | 66 | 6,623 |
| Sum | $832,695 | $921,000 | $9,292 | $31,464 | $47,549 | $88,305 |

Balance: $832,695

Local Air Quality Agency: **Northwest Air Pollution Authority**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 70,125 | 0 | 0 | 0 | 0 |
| 2nd QTR | 70,125 | 70,125 | 0 | 0 | 0 | 0 |
| 3rd QTR | 140,250 | 70,125 | 0 | 0 | 0 | 0 |
| 4th QTR | 210,375 | 70,125 | 20,695 | 0 | 0 | 20,695 |
| 5th QTR | 259,805 | 67,056 | 43,115 | 0 | 0 | 43,115 |
| Sum | $286,815 | $347,556 | $63,810 | $0 | $0 | $63,810 |

Balance: $287,746

Local Air Quality Agency: **Olympic Region Clean Air Agency**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 109,438 | 0 | 1,272 | 0 | 1,272 |
| 2nd QTR | 108,166 | 109,438 | 0 | 4,240 | 0 | 4,240 |
| 3rd QTR | 213,364 | 109,438 | 0 | 7,466 | 7,500 | 14,966 |
| 4th QTR | 307,836 | 109,438 | 63,653 | 5,388 | 0 | 69,041 |
| 5th QTR | 348,233 | 96,903 | 212,117 | 7,633 | 0 | 219,750 |
| Sum | $225,386 | $534,655 | $275,770 | $25,999 | $7,500 | $309,269 |

Balance: $225,386

Local Air Quality Agency: **Puget Sound Clean Air Agency**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 428,188 | 53,480 | 0 | 0 | 53,480 |
| 2nd QTR | 347,708 | 428,188 | 0 | 0 | 0 | 0 |
| 3rd QTR | 802,896 | 428,188 | 129,393 | 0 | 0 | 129,393 |
| 4th QTR | 1,101,691 | 428,188 | 235,984 | 0 | 0 | 235,984 |
| 5th QTR | 1,293,895 | 471,718 | 357,949 | 0 | 0 | 357,949 |
| Sum | 1,407,664 | 2,184,470 | 776,806 | 0 | 0 | 776,806 |

Balance: $1,407,664

Local Air Quality Agency: **Spokane Clean Air Authority**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 109,438 | 0 | 890 | 0 | 890 |
| 2nd QTR | 108,548 | 109,438 | 0 | 1,140 | 0 | 1,140 |
| 3rd QTR | 216,846 | 109,438 | 0 | 1,975 | 0 | 1,975 |
| 4th QTR | 324,309 | 109,438 | 39,616 | 2,531 | 0 | 42,147 |
| 5th QTR | 391,600 | 80,633 | 25,875 | 603 | 0 | 26,478 |
| Sum | $445,755 | $518,385 | $65,491 | $6,536 | $0 | $72,630 |

Balance: $445,755

Local Air Quality Agency: **Southwest Clean Air Agency**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 149,813 | 0 | 699 | 0 | 699 |
| 2nd QTR | 149,114 | 149,813 | 0 | 2,630 | 0 | 2,630 |
| 3rd QTR | 296,297 | 149,813 | 0 | 2,117 | 0 | 2,117 |
| 4th QTR | 443,993 | 149,813 | 27,595 | 1,849 | 17,700 | 47,144 |
| 5th QTR | 546,662 | 81,873 | 87,428 | 3,883 | 10,925 | 102,237 |
| Sum | $526,298 | $681,125 | $115,023 | $11,179 | $28,625 | $154,827 |

Balance: $526,298

Local Air Quality Agency: **Yakima Regional Clean Air Authority**

| Quarter | Carry Forward | Quarterly Revenue | Retrofit Expense | Admin Expense | Other Expense | Total Expense |
|---|---|---|---|---|---|---|
| 1st QTR | 0 | 55,250 | 0 | 1,734 | 0 | 1,734 |
| 2nd QTR | 53,516 | 55,250 | 0 | 4,523 | 0 | 4,523 |
| 3rd QTR | 104,243 | 55,250 | 12,536 | 2,313 | 0 | 14,850 |
| 4th QTR | 144,643 | 55,250 | 20,089 | 3,444 | 67 | 23,600 |
| 5th QTR | 176,293 | 51,618 | 67,495 | 2,752 | 0 | 70,247 |
| Sum | $157,664 | $272,618 | $100,120 | $14,766 | $67 | $114,954 |

Balance: $157,664

## *Appendix F: Other Projects that Reduce Diesel Emissions*

The purpose of Engrossed Substitute Senate Bill (ESSB) 6072 is to reduce school children's exposure to airborne particulates generated by diesel school buses. Therefore, 85 percent of the funds received by both Ecology and local air agencies must be used to retrofit school buses with emission control equipment, or provide funding for school bus refueling infrastructure necessary to use alternative, cleaner fuels. The remaining 15 percent of these funds may be used as above, or to reduce motor vehicle emissions, clean up air pollution, or monitor and reduce toxic air contaminants.

Summary of Projects Funded through 15% Flexible Funding

| Project | Lead Agency | Recipient | Funding |
|---|---|---|---|
| School Bus Check-up | Ecology | Statewide | $31,542 |
| Bio-diesel (B-20) | Ecology | Central Valley School District - Spokane County | $31,710 |
| Bio-diesel (B-20) | ORCAA | Jefferson County Transit | $7500 |
| Total | | | $70,752 |

**The Washington State School Bus Check-Up Program:**

SUMMARY: The Department of Ecology conducts an emissions test on school buses for school districts that are located in Ecology's five-county, vehicle inspection and maintenance (I/M) Program area. As an extension of the Washington State Patrol's (WSP) School Bus Safety Inspection Program and Ecology's I/M Program, I/M staff trained WSP inspection staff to emissions test school buses in those counties outside of the I/M area. Training included proper administration of paperwork and use and maintenance of opacity equipment. The Office of Superintendent for Public Instruction (SPI) and WSP compile data consisting of vehicle year, size, engine type and size, vehicle use, mileage and opacity readings. Ecology reviews this data and provides SPI with maintenance recommendations to help reduce emissions. The opacity readings from the emission testing will be used as tool to identify vehicles in need of advanced maintenance or repair.

COST: Educational Service District 101 purchased 9 Wager opacity meters (sensor head, software, and printer) at a cost of $2970 each, for a total equipment cost of $26,730. Additional costs include sales tax ($2272), plus a 9.5 percent ($2540) ESD processing fee, bringing the total costs to $31,542. Additional anticipated costs include development of an electronic data transfer system during 2005.

REPORTING: SPI will provide progress reports to Ecology leads, which will maintain records and report progress to the AQ Program's Steering Committee.

BENEFITS: This collaboratively (SPI/WSP/ECY) developed program reduces additional emissions beyond the retrofit program, improves fuel economy, and provides school districts a fleet education/maintenance program. Expanding this program statewide insures equity among school districts in both urban and rural areas.

**Cleaner Fuels: B20 for Central Valley School District**

SUMMARY: ESHB 1243 is an unfunded mandate requiring the Office of Superintendent of Public Instruction (OSPI) to conduct a pilot project on the use of biodiesel, ultra-low sulfur diesel (ULSD), and ULSD combined with bio-diesel on diesel school buses at two school districts during the 2003-2004 and 2004-2005 school years. Ecology is providing OSPI funding to offset the increased cost of a 20 percent biodiesel blended, B20, with regular on-highway diesel at the Central Valley School District in Spokane. Ecology will continue to fund the cost differential for B20 to Central Valley School District during the 2004-2005 school year. The Puget Sound Clean Air Agency and Ecology will fund the cost differential for ultra-low sulfur diesel and B20 at the North Shore School District during the 2004-2005 school year.

COSTS: $31,710 to offset the cost to provide a 20 percent biodiesel blend for 100 percent of the diesel fleet.

REPORTING: Ecology conducted baseline emission tests in 2002, prior to providing the 20 percent biodiesel blend. Ecology will conduct additional annual emissions testing, and provide this data to OSPI for a report to the legislature in 2005.

BENEFITS: Reduced fine particles from tailpipe emissions.

**Cleaner Fuels: B20 for Jefferson County Transit**

SUMMARY: The Olympic Region Clean Air Agency is providing funding to offset the increased cost of a 20 percent biodiesel blended, B20, with regular on-highway diesel for Jefferson County Transit. Jefferson County Transit transports children to and from school as part of their regularly scheduled routes.

COSTS: $7500 to offset the cost to provide a 20 percent biodiesel blend for a portion of the diesel fleet.

BENEFITS: Reduced fine particles from tailpipe emissions.

## *Appendix G: Next Steps and Future Recommendations*

Several next steps have been identified for the second year of the program. These steps will insure that the program continues to make sound and cost effective decisions.

During the next year, the program will address the following items:

1. Continue to achieve 100 percent participation from school districts.

2. Complete the retrofitting of all model year 2000 and older school buses with diesel oxidation catalysts.

3. Retrofit all model year 1988 and newer school buses with crankcase ventilation filters.

4. Implement an improved school bus maintenance program specifically designed to reduce school bus emissions, including development of an electronic data transfer system that tracks performance.

5. Complete an assessment of diesel particle filters to determine which types (passive regenerative, continuously regenerative, etc.) are technologically appropriate and most cost effective including maintenance costs, for school bus retrofits.

6. Evaluate the cost effectiveness of retrofitting model year 2001 and newer school buses with diesel particle filters vs. diesel oxidation catalysts.

7. Based upon the results from (3) and (4), develop and implement a state contract to obtain a competitive price for particle filter installation.

8. Based upon the results from (3) and (4) and (5), develop a third through fifth year retrofit plan and schedule for particle filter installations, including an assessment of revenue vs. costs.

9. Increase efforts to leverage federal grant funds with existing state funds.

10. Evaluate the need to seek additional supplementary state funds or extend current funding beyond the current five-year period.