[Penn State Environmental Law Review](https://elibrary.law.psu.edu/pselr)

Volume 16 | Number 1 Article 7

9-1-2007

The Danger of School Buss Diesel Exhaust: How Inadequate Regulation and Funding Is Threatening America's School Children

Adam Delph

The Danger of School Bus Diesel Exhaust: How Inadequate Regulation and Funding Is Threatening America's School Children

Adam Delph*

I. Introduction

School bus diesel exhaust (DE) has recently been identified as a severe health risk to school children. Although tailpipe emissions are currently unregulated by the federal government, many federal agencies have begun to recognize the growing threat of this specific health risk to the nation's school children. Many states have also begun to respond, implementing their own initiatives and funding programs to curtail the potentially deadly risk of school bus DE. However, absent further regulation or funding, the threat of school bus DE may go largely unchecked. The federal, state, and local governments must each cooperate to attack this growing danger, through regulation of tailpipe emissions and public funding for new technologies that will make school bus emissions safe.

II. Background Information

Nearly 600,000 school buses transport 24 million children to school each day in the United States. Parents rely on these school buses to safely transport their children to and from school every day. Although school buses have traditionally been regarded as a safe way to transport children to and from school, their environmental danger has historically gone unnoticed. Average exposures to DE on school buses are five to six times greater than outside the bus and three times greater than walking

---

* J.D. Candidate, The Dickinson School of Law of the Pennsylvania State University, May 2008. The author would like to thank his family for their encouragement, in regards to both writing this article and pursuing a career in the legal field. Thanks to Chris Botto for providing a good example of work ethic and a constant stream of "constructive criticism." Mostly, thanks to DD for the coffee that made this article possible.

the average commute.[1]

This is an important consideration, since DE has been consistently identified as a serious health risk. Specifically, many studies indicate that DE poses both carcinogenic and non-carcinogenic health risks, such as asthmatic irritation and other lung problems associated with the physiological makeup of school children. Recently, the danger of DE and its specific health risk to children has been overwhelmingly confirmed.

III. The Intrinsic Danger of Diesel Exhaust

A. *Physical Composition*

Diesel exhaust, emitted from "on road" diesel engines, contains a mixture of gas and particulate matter.[2] The various gases found in DE include carbon dioxide, nitrogen, water vapor, carbon monoxide, nitrogen compounds, sulfur compounds, and low-molecular weight hydrocarbons.[3] The hydrocarbon elements of DE that are considered toxic include the aldehydes (i.e. formaldehyde, acetaldyhyde, and acrolein), benzene, butadiene, polycyclic aromatic hydrocarbons, and nitro-hydrocarbons.[4] Diesel particulate matter (DPM), contained in DE, is composed of both elemental carbon and absorbed organic compounds.[5] Particulate matter is characterized as either fine particulate matter (diameter $<2.5\mu m$) or ultrafine particulate matter (diameter $<0.1\mu m$).

DPM is currently considered to be the most hazardous element of DE.[6] DPM's particular toxological significance is its large surface area, making it well-suited to absorb organics, and its small size, making it highly breathable.[7] Many of the organic compounds carried in DPM are widely known to be mutagenic or carcinogenic.[8] Additionally, many of the compounds found on DPM may last anywhere from hours to days. Therefore it is important to identify both the long-term and short-term health effects of DE exposure.

---

1. Environmental Defense Fund, *Clean School Buses,* http://www.environmentaldefense.org/article.cfm?contentID=5340&linkID=100 (last visited Dec. 2, 2007).
2. ENVIRONMENTAL PROTECTION AGENCY [EPA], EPA HEALTH ASSESSMENT DOCUMENT FOR DIESEL EXHAUST 1-1 (2002), *available at* http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=29060.
3. *Id.* at 1-2.
4. *Id.*
5. *Id.*
6. *Id.* at 1-5.
7. *Id.*
8. EPA, *supra* note 2, at 1-5.

B. *Health Hazards of Diesel Exhaust*

1. General Health Hazards

The general health hazards posed by diesel emissions include short-term, non-carcinogenic effects, and long-term, carcinogenic effects.[9] Non-carcinogenic effects include acute irritation (i.e. irritation of the eyes, throat, and bronchi), neurophysiologic symptoms, and respiratory symptoms (i.e. asthma).[10] Specifically, DPM may decrease lung function and exacerbate lung conditions such as bronchitis and emphysema, causing premature death in some cases.[11] DPM has been linked to increased hospitalization for respiratory diseases, chronic obstructive lung disease, pneumonia, and heart disease.[12]

Studies also strongly support the conclusion that exposure to DE may be highly carcinogenic as a long-term effect.[13] The U.S. Department of Health and Human Services' National Toxicology Program has classified DE as "Reasonably Anticipated to Be a Human Carcinogen,"[14] as has the International Agency for Research on Cancer (IARC).[15] The California Scientific Review Panel found DE to be the sixth most dangerous carcinogenic substance reviewed and found a 40 percent increased risk of lung cancer to those exposed to DE over a long period of time.[16] They concluded that there was no known level of DE exposure to which no carcinogenic effects could be attributed.[17] The South Coast Air Quality Management District of Southern California (SAQMD) found that 71 percent of the total cancer risk attributable to air pollution comes from DE.[18] The State and Territorial Air Pollution

9. *Id.* at 1-6. The particular problem of asthma will be treated in the following section, as it bears most directly on school-age children.

10. *Id.*

11. MORTON LIPPMANN, ENVIRONMENTAL TOXICANTS: HUMAN EXPOSURES AND THEIR HEALTH EFFECTS 16-17 (VAN NOSTRAND REINHOLD 1992).

12. D.W. Dockery et al., *An Association Between Air Pollution and Mortality in Six U.S. Cities*, 329 NEW ENG. J. MED. 24, 1753-59 (1993).

13. EPA, *supra* note 2, at 1-6.

14. *See* U.S. DEP'T HEALTH & HUM. SERVS., NINTH REPORT ON CARCINOGENS, CAS No. 1746-01-6 (2001).

15. *See* INT'L AGENCY FOR RES. ON CANCER [IARC], *Diesel and Gasoline Engine Exhausts and Some Nitroarenes*, 46 MONOGRAPHS ON THE EVALUATION OF CARCINOGENIC RISKS TO HUMANS (1989).

16. CAL. SCI. REV. PANEL, FINDINGS OF THE SCIENTIFIC REVIEW PANEL ON THE REPORT ON DIESEL EXHAUST 1 (1999), *available at* http://www.californialung.org/spotlight/cleanair03_research.html.

17. *Id.* at 5.

18. S. COAST AIR QUALITY MANAGEMENT DIST., MULTIPLE AIR TOXICS EXPOSURE STUDY IN THE SOUTH COAST AIR BASIN ES-9-10 (2000), *available at* http://www.aqmd.gov/matesiidf/matestoc.htm.

Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO) have concluded that DE is responsible for over 125,000 cancer deaths every year in the United States alone.[19] S. William Becker, Executive Director of STAPPA/ ALAPCO, has gone further to comment that "the actual number of cancers could easily be ten times higher."[20] These risks apply to every individual exposed to DE. The DE emitted by school buses however, most directly affects school-aged children. Therefore, it is important to understand the specific health risks that DE poses to school-age children.

2. Specific Diesel Exhaust Health Hazards to Children

a. Physiological Susceptibility

DE poses an especially dangerous health risk to children due to their particular physiology. Respiratory airways develop gradually throughout early childhood.[21] Rapid rates of cell differentiation, cell division, and airway branching make the time of early childhood and young adulthood a period of growth that is especially susceptible to the toxic effects of DE.[22] Alveoli replenish the blood with oxygen and remove carbon dioxide, and 80 percent of an adult's alveoli develop during early childhood.[23] Additionally, children are more exposed to toxic hazards in general, since they breathe more air on average than adults, which increases during periods of physical activity.[24] One of the greatest childhood dangers of DE is its exacerbation of asthma.

b. Asthma

Asthma is a chronic inflammatory disorder of the airways, which may become highly responsive to contaminants in the air.[25] The physical

19. State and Territorial Air Pollution Program Adm'rs and the Ass'n of Local Air Pollution Control Officials, Cancer Risk from Diesel Particulate: National and Metropolitan Area Estimates for the United States 38 (2000), *available at* http://www.4cleanair.org/comments/Cancerriskreport.PDF.

20. Press Release, State and Territorial Air Pollution Program Admr's and the Ass'n of Local Air Pollution Control Officials, More than 125,000 to Get Cancer From Diesel Fumes, Concludes New State-Local Government Analysis (March 15, 2000), *available at* http://www.4cleanair.org/comments/cancerriskrelease.PDF.

21. J. Schwartz et al., *Analysis of Spirometric Data from a National Sample of Healthy 6-to-24-year-olds*, 138 AM. REV. RESPIRATORY DISEASE, 1405-14 (1988).

22. *Id.*

23. *Id.*

24. *See* Nat'l Research Council, PESTICIDES IN THE DIETS OF INFANTS AND CHILDREN (1993).

25. *See* NAT'L ACAD. OF SCI., INST. OF MED., CLEARING THE AIR: ASTHMA AND INDOOR AIR EXPOSURES (1999).

consequences of asthma are constriction and inflammation of the muscles around the airways, reducing airflow to the alveoli. A variety of factors may trigger asthma (i.e. dust, smoke, pesticides, paint fumes, etc.), and DE tends to induce and increase the severity of asthma.[26] This exacerbation is an important consideration, since asthma has become the most prevalent disease among children in the United States.[27]

Almost 5 million children in the U.S. have been diagnosed with asthma, which represents about 7 percent of the children in the U.S.[28] Nearly 160,000 children are hospitalized each year due to asthma,[29] especially in urban areas where ambient air pollution is highest[30]. The death rate of asthmatic children nineteen years old and younger increased by 78 percent between 1980 and 1993.[31] This type of change has occurred too rapidly to be the result of genetics; it is most likely the product of chemical, physical, and biological changes in their environment.[32]

Children previously diagnosed with asthma are 40 percent more likely to have an asthma attack on high outdoor pollution days.[33] Particle deposition and retention have been shown to be higher among severely asthmatic children; therefore the intake of particulates may be higher among severely asthmatic children.[34] In addition, DPM may not only cause but exacerbate allergic reactions; enhanced DPM concentrations have been shown to cause severe allergic reactions, some even resulting in death.[35] Children living near high traffic flow have more medical visits per year on average than those living near low traffic flows.[36] Further, children living in areas with ambient air levels of PM_{10} have had

---

26. M. Aubier, *Air Pollution and Allergic Asthma*, 17 REVUE DES MALADIES RESPIRATOIRES, 159-65 (2000) (Fr.).

27. Centers for Disease Control and Prevention (CDCP), http://www.cdc.gov/HealthyYouth/asthma/index.htm (last visited Dec. 2, 2007).

28. *Id.*

29. CDCP, SURVEILLANCE FOR ASTHMA-U.S., 1960-1995, 47(SS-1) MORBIDITY AND MORTALITY WEEKLY REPORT, T-1 (1998).

30. L. Claudio et. al., *Environmental Health Sciences Education—a Tool for Achieving Environmental Equity and Protecting Children*, 106 ENVTL. HEALTH PERSP. S3, 849-855 (1998).

31. IARC, *supra* note 15.

32. JOHN WARGO, ENVT'L. & HUMAN HEALTH, CHILDREN'S EXPOSURE TO DIESEL EXHAUST ON SCHOOL BUSES 16 (2002).

33. EPA, THE EPA CHILDREN'S ENVIRONMENTAL HEALTH YEARBOOK 10 (1998).

34. C. Weisel et al., *Relationship between Summertime Ambient Ozone Levels and Emergency Department Visits for Asthma in Central New Jersey*, 103 ENVTL. HEALTH PERSP. S3, 97-102 (1995).

35. Hillel Koren, *Associations between Criteria Air Pollutants and Asthma*, 103 ENVTL. HEALTH PERSP. S6, 235-42 (1995).

36. P. English et al., *Examining Associations between Childhood Asthma and Traffic Flow Using a Geographic Information System*, 107 ENVTL. HEALTH PERSP. S9, 761-7 (1999).

lower rates of lung growth, compared to those children living in areas under PM_{10} that have had higher rates of lung growth.[37] In sum, DE is especially and particularly a severe health risk to children. Children are most exposed to the severe health risks of DE in a place known for its safety: the school bus.

IV. Diesel Exhaust Exposure in Public School Buses

Numerous studies have been conducted by private organizations and state entities to examine DE levels aboard school buses. Environment and Human Health, Inc. (EHHI) performed one of the first studies to bring attention to the problem.[38] Researchers took measurements of DPM aboard school buses in Stors, Connecticut, for an average of seven hours per day.[39] The buses made four to eight stops per day, at intervals of thirty seconds in order to simulate entry and exit of children on the bus. Each bus made eight runs per day for four days and was tested in order to understand the dynamics of having bus windows open or closed and the variability of the location of testing equipment. Researchers placed one monitor in the first seat behind the bus driver and one in the last seat of the bus.[40] The EHHI study also measured the DE intake of students.

For the second part of the study, each student carried a PM meter with them throughout their day. The highest indoor levels of PM inhalation by children occurred after intense physical activity, like gymnastics, moving from class to class, and some other class activities.[41] The study indicated that DPM exposure by children riding the bus was seven times higher than when they were either entering or exiting the bus.[42] In every case, DPM levels tended to increase upon entrance to the bus and decrease upon exiting the bus.[43] While children rode the bus, their average exposure to DPM was five to ten times higher than the ambient averages reported by state monitoring efforts.[44]

Changes in concentration were most often due to changes in wind

37. E. Avol et al., *Respiratory Effects of Relocating to Areas of Differing Air Pollution Levels*. 164 AM. J. RESPIRATORY & CRITICAL CARE MED. 11, 2067-72 (2001).

38. Wargo, *supra* note 32, at 2.

39. The studies may, however, underestimate DE exposure on school buses; there was a smaller load on the engine than normal, because the buses were not carrying children at the time of measurement. *Id.* at 5.

40. There was no documented difference in PM exposure between the back and front of the bus. *Id.*

41. *Id.*

42. *Id.*

43. This decline was sometimes delayed, due to the DE exposure of other idling school buses in the area. Wargo, *supra* note 32, at 6.

44. *Id.*

direction, whether windows were open or closed, the quality and location of the exhaust pipe, ambient air quality, and traffic. When bus windows were closed, PM levels increased at stops due to emission from the rear tailpipe. When windows were open, PM levels tended to decrease. DE also contaminated the passenger compartment of the bus when the bus stopped and opened its door, through unsealed engine compartments, leaking exhaust systems, and unfiltered air/heating vents. An increased exposure to DE occurred when the buses were idling. This created a "legacy effect" that lingered inside the bus during its run, depending on length of idling time, window configuration, and traffic intensity. Overall, the EHHI study produced an irrefutable basis for concluding that students were exposed to highly dangerous DE levels aboard school buses while they traveled between home and school.[45]

The National Resource Defense Council (NRDC) built upon the EHHI study to create more specific estimates of DE exposure aboard school buses,[46] finding that the majority of the nation's school buses ran on diesel fuel[47]. DE exposure aboard a school bus was, on average, four times as much as riding in a car that was in front of the school bus, and 8.5 times higher than the average statewide exposure. Overall, the NRDC estimated that for every million children riding a bus for one to two hours per day, twenty-three to forty-six of them may develop cancer, which is forty-six times the risk considered "significant" by the EPA.[48]

The Clean Air Task Force (CATF) performed a third study that focused on particular school bus scenarios: idling, the middle of a three bus line, and the running of a typical route for one hour.[49] The greatest factor that determined the amount of DE that entered the bus through a certain area was usually the wind. The concentration of DE aboard the bus depended on the direction of the wind, relative to the tailpipe or the engine crankcase. DE from the tailpipe tended to enter the bus door in the front and migrate toward the back of the bus. The DE from the crankcase came from the road draft tube, which would emit DE into the cabin when the bus stopped.[50] Tailpipe emissions contributed to the

---

45. *Id.* at 6.

46. *See* NATURAL RES. DEF. COUNCIL [NRDC], NO BREATHING IN THE AISLES: DIESEL EXHAUST IN SCHOOL BUSES (2001).

Unlike the EHHI study, NRDC found that DE exposure was actually higher in the back of the bus than in the front, but similarly found that exposure rates were higher when the windows of the bus were closed. *Id*

47. *Id.* at 1.

48. *Id.*

49. Clean Air Task Force, A Multi-City Investigation of the Effectiveness of Retrofit Emissions Controls in Reducing Exposures to Particulate Matter in School Buses 3 (2005).

50. There was actually a visible plume of smoke arising out of the tube. *Id.* at 5.

buildup of DE in the cabin of the bus when wind came from the rear.[51] It concluded that most of the PM in the bus originated from the engine crankcase when the wind came from the front. When the buses were idling, there existed an overall decrease in air quality, similar to the results found in previous studies.[52] These studies have consequentially contributed to awareness of the situation, which has led to various avenues of remedial action.

V. Current Remedial Action

Though the amount of DE exposure has varied in different situations, the major studies have conclusively determined that there is a very high risk of exposure to DE on school buses, which is extremely harmful to the young children that are exposed daily to its hazardous components. All levels of government have since recognized this danger, which has prompted specific legislation and government action. These government actions have either directly financed remedial measures or at least mandated higher air quality inside school buses, primarily through existing and developing technologies.

A. Existing and Developing Technologies

New technologies are what have largely been used thus far to curb the dangers of school bus DE. Although some states and municipalities have enacted laws that merely regulate the use of school buses,[53] many have implemented "clean school bus" programs, similar to those funded by the EPA. The general trend of these programs has been to outfit existing school buses with "retrofit" technologies and cleaner fuels.

Retrofit pollution controls have been implemented into over 25,000 school buses nation-wide, reducing DE by fifty-nine tons in 2005.[54] Such retrofits include PM traps and crankcase filtration controls, many of which have been officially verified by CARB and the EPA. In particular, Diesel Particulate Filters (DPFs) may reduce DPM emission by 60-85 percent or more. In order to meet 2007 EPA requirements, it is likely that every school bus will be equipped with DPFs.[55]

DPF traps employ the method of "passive regeneration", utilizing a

---

51. *Id.* at 58.

52. NRDC, *supra* note 46, at 49.

53. *See* State Environmental Resource Center [SERC], Issue: School Bus Diesel Emissions, http://www.serconline.org/schoolbus/stateactivity.html (last visited Dec. 2, 2007).

54. UNION OF CONCERNED SCIENTISTS [UCS], SCHOOL BUS POLLUTION REPORT CARD 2006 27 (2006).

55. *See* EPA, HEAVY-DUTY ENGINE AND VEHICLE STANDARDS AND HIGHWAY DIESEL FUEL SULFUR CONTROL REQUIREMENTS (2000).

catalyst that lowers the temperature at which DE will burn off.[56] Therefore no additional energy is required to burn away the DE particles. This process is combined with an ultra-low sulfur diesel fuel, now required for all highway diesel vehicles.[57] Such technology is usually used on older buses, but it can only be used on buses that produce enough heat for the process. Other buses have been retrofitted using "active regeneration", which can be used on any age bus. This process adds heat to the cycle to disintegrate DE particles. Diesel Oxidation Catalysts (DOCs) are another answer that many states have used to address the problem of school bus DE, as they have consistently decreased DE pollution by 20-40 percent.[58]

Effective as these processes are, other technologies attack DE from the inside. There are various technologies that offer onboard pollution controls. Some studies indicate that controlling emissions is not enough to curb DE exposure aboard school buses; many filtration systems still allow high amounts of DE onboard school buses.[59] Therefore a combination of filtration technology and onboard pollution control has been found to be the most effective method of preventing DE exposure. The only technology of this sort that is currently in use is crankcase filtration.

Another method that has become both common and useful has been alternative fuels. Over twenty-three tons of DE pollution has been cut across America through biodiesel or cleaner alternative fuels, in 13,000 school buses. Additionally, hybrid-electric school buses are also expected to rise in popularity as they are introduced into the market. The hybrid engines allow better fuel economy at a lower emissions rate.[60] However, if the hybrid engines run partly on diesel fuel, the emissions problem is not solved. An effective hybrid engine will combine the benefit of cleaner fuels with the benefits of a lower emission rate.[61] Although this technology has been introduced into the bus transit market, it might be some time before it is introduced into the school bus market.

Finally, fuel cells may prove to be the most effective tool in fighting DE on school buses. This technology results in near-zero emissions, and it possesses the potential for zero-emissions when hydrogen is introduced into the process.[62] The most popular type of fuel cell today is Proton Exchange Membrane (PEM) technology. PEM involves the conversion

56. *Id.* at 28.
57. *Id.*
58. More than 14,000 school buses have been retrofitted across America. *Id.* at 29.
59. *Id.*
60. NRDC, *supra* note 46, at 21.
61. *Id.*
62. *Id.* at 22.

of chemical energy into a usable form of energy and heat, without combustion.[63] Although fuel cells run on pure hydrogen, they have the potential to run on other fuel types when reformed into pure hydrogen.[64] This technology is not yet available for school buses, but it is being tested on various transit systems throughout the world. These new technologies have begun to be funded at both the federal and state levels of government.

B. Federal Measures

Air pollution within motor vehicles remains federally unregulated in the U.S., and exposure limits have not yet been set for occupational settings.[65] Tailpipe emissions are currently only regulated by state laws.[66] Even so, there have been noteworthy federal efforts to fund cleaner school buses.

One of the first attempts toward the federal funding of cleaner school buses was the "Clean Green School Bus Act of 2001".[67] Although the bill never passed both houses of Congress, it would have been a major step in cleaning-up the air inside school buses. The bill called for a Department of Energy pilot program that would grant $300 million to states over ten years, in order to purchase new, cleaner buses and retire older buses.[68] Many proponents of the bill felt that federal funding was necessary in order confront the threat of DE aboard school buses, including Patricia Monahan, an author of the Union of Concerned Scientists' (UCS) "Pollution Report Card," who believed that school districts should not have to pay for alternative fuels by themselves.[69] She was convinced that the Act would not only protect children's health, but that funding alternative fuels would also promote national security and safeguard the economy.[70] Another strong proponent of the bill was International Truck and Engine Corporation (ITEC), which produces ultra-low sulfur, "Green Diesel" buses.[71] ITEC agreed that federal funding was necessary in order to make cleaner buses a reality in most states.[72] Unfortunately, the Act was incorporated into a larger Energy

---

63. *Id.*
64. *Id.*
65. Wargo, *supra* note 32, at 33.
66. *Id.*
67. Clean Green School Bus Act of 2001, H.R. 2518, 107th Cong. 2001.
68. School Transportation News [STN], *Proposed Bill Aims to Clean Up Nation's School Buses,* http://www.stnonline.com/stn/cleanschoolbus/csb_legislation.htm#6 (last visited Dec. 2, 2007).
69. *Id.*
70. *Id.*
71. *Id.*
72. *Id.*

bill, which Congress failed to pass. Although the "Clean Green School Bus Act of 2001" did not succeed, some federal agencies have subsequently begun to take alternate action against school bus DE.

The Environmental Protection Agency's (EPA) most directly pertinent regulation is a set of measures that took effect in 2007: "Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements."[73] This enactment set new, more restrictive exhaust emission standards for heavy-duty vehicles, such as school buses. These standards are largely technology-based, high-efficiency catalytic exhaust emission control devices and similar technologies. This enactment should reduce overall current emission levels of DPM by 90 percent.[74] In terms of health effects, these new standards should result in 8,300 fewer premature deaths, 17,600 fewer cases of childhood acute bronchitis, and 360,000 fewer asthma attacks by the year 2010.[75] However, the EPA acknowledges that it will take some time to replace old school buses with new, emission controlled ones.

In light of this problem, the EPA has initiated a program designed to address the DE problem aboard existing school buses, called "Clean School Bus USA." This program is a public-private environmental partnership that seeks to reduce children's exposure to air pollution from diesel school buses.[76] It also includes the EPA's "National Idle-Reduction Campaign," which focuses on educating school bus drivers about the DE danger inherent in idling and promotes safer idling practices.[77] In 2006, Congress allocated $7 million for the program, which has gone toward replacing and/or retrofitting existing school buses[78], throughout thirty-five school districts.[79] "Clean School Bus USA" aims to jump-start the process by working with different groups to emphasize three ways to reduce public school bus emissions: anti-idling strategies, engine retrofit/clean fuels, and bus replacement.[80]

In order to further these goals, Congress also approved the EPA's

73. EPA, *supra* note 55.

74. Wargo, *supra* note 32.

75. EPA, *EPA Dramatically Reduces Pollution from Heavy-Duty Trucks and Buses; Cuts Sulfur Levels in Diesel Fuel*, Dec. 21, 2000, *available at* http://yosemite.epa.gov/opa/admpress.nsf/b1ab9f485b098972852562e7004dc686/405d2f1b56c262e9852569bc00558db3.

76. EPA, http://www.epa.gov/cleanschoolbus/basicinfo.htm (last visited Dec. 2, 2007).

77. EPA, http://www.epa.gov/cleanschoolbus/antiidling.htm (last visited Dec. 2, 2007).

78. EPA, http://www.epa.gov/otaq/schoolbus/funding.htm (last visited Dec. 2, 2007).

79. EPA, http://www.epa.gov/otaq/schoolbus/demo_projects.htm (last visited Dec. 2, 2007).

80. EPA, *supra* note 76.

"Blue Skyways Collaborative Clean School Bus Grant Competition."[81] Through this grant program, certain school districts can receive funding for verified, pollution reduction technology. The EPA estimates that $1.14 million will be awarded, with approximately six to twenty-two awards expected to be made, averaging $50,000 to $200,000 each.[82] Additionally, the EPA funds the "Transportation Equity Act for the 21st Century and the Congestion Mitigation and Air Quality Program" (TEA-21).[83] This program allocates $8.1 million over six years to states and local governments in order to keep them compliant with the Clean Air Act.[84] Since school bus DE is not currently regulated by the federal government, TEA-21 may enable state funding to be allocated toward cleaning up school bus DE, instead of compliance with the requirements of the Clean Air Act.

Other agencies, like the Department of Energy (DOE), have also begun to fund the clean-up of DE in school buses. DOE's "Clean Cities" program is attempting to facilitate the transition to biodiesel and alternative fuels. However "Clean Cities" does not go as far as producing direct funding for cleaner school buses. Instead it draws together leaders from federal, state, and local governments, as well commercial fleets and transportation departments, to collaborate on mutually beneficial ways to make new fuels and technologies available.[85] It remains to be seen how such communities will affect the problem of school bus DE exposure.

At the very least, such communities may facilitate communication between its various members, hopefully leading to new ways of implementing new technology and alternative fuels into the existing school bus fleet. Regardless, such technologies still require adequate funding for implementation. While funding is still a large roadblock for some states, other states have implemented relatively successful programs aimed at reducing children's exposure to school bus DE.

C. *State Measures*

The danger of DE throughout the states varies, based on the age of school buses, fuel choice, and the use or non-use of retrofit technologies.[86] The Union of Concerned Scientists (UCS) has produced

81. *Id.*
82. *Id.*
83. TEA-21, http://www.fhwa.dot.gov/tea21/sumenvir.htm (last visited Dec. 2, 2007).
84. *Id.*
85. *See* Department of Energy [DOE], http://www.eere.energy.gov/cleancities/ (last visited Dec. 2, 2007).
86. UCS, *supra* note 54.

a report that evaluates the various states and their approaches to cleaning school bus emissions. UCS has stated that although some states have ignored the problem,[87] the states that have addressed the problem have made significant progress.[88]

The UCS has found that the result of local, state, and federal action has been a nation-wide reduction of DE pollution by only 2 percent.[89] Yet the leading states, California and Washington, have reduced state-wide DE pollution by more than 7 percent. California's "Lower-Emission School Bus Program" was one of the first programs in the country to specifically address school bus DE. Through this program, California has allocated $25 million to the California Air Resources Board (CARB) for the purpose of purchasing new, cleaner school buses and retrofit technology for the remainder of the bus fleet.[90] The result has been that nearly 10 percent of its school buses have been retrofitted with PM traps, and it has replaced hundreds of older buses with new retrofitted buses.[91] Washington has committed $5 million per year to retrofit all of its buses.[92] Ohio is drawing funds from civil non-compliance penalties to generate $300,000-$400,000 per year to clean-up its school buses.[93]

Also, numerous states are using settlement funds from legal actions to pay for their retrofit programs, and other states have general funds available, such as North Carolina and Texas, to meet federal air quality standards.[94] Though these funds are not directed at school buses specifically, the Texas Emission Reduction Program (TERP) and the North Carolina Mobile Source Emissions Reduction Grants may help to fund efforts for cleaner school buses, by providing their school bus fleets with new technology that will reduce DE exposure to students.[95] However, funding new technology for school buses is not the only way that states have attacked the DE problem.

Many states have successfully implemented regulations that limit children's DE exposure aboard school buses. California's "Airborne Toxic Control Measure to Limit School Bus Idling and Idling at Schools" (ATCM) is a state regulation that limits unnecessary idling, so

---

87. Nine states and the District of Columbia do not appear to have taken any action, as of 2005. Thirteen other states have small programs, resulting in less than 1 percent DE reduction. *Id.* at 4.

88. *Id.*

89. *Id.*

90. CAL. AIR RES. BD., LOWER-EMISSION SCHOOL BUS PROGRAM 1 (2006).

91. UCS, *supra* note 54, at 34.

92. *Id.*

93. *Id.*

94. *Id.*

95. *Id.*

that children's exposure to DE is limited.[96] At least twenty other states have passed similar anti-idling regulations,[97] and a few states have gone as far as requiring cleaner fuels and retrofits.[98] Most efforts to decrease the danger of DE have been successful, because they have faced minimal opposition.

D. *Opposition to Remedial Efforts*

Specific counter arguments against claims of school bus DE health risks have been generally minimal. The only recorded study that has been produced to counter existing school bus DE studies is a report by the Fairfax County Public School District (FCPS) in Virginia.[99] The county reported, "the concentration of diesel exhaust on FCPS school buses is below the limits of detection and . . . there is no significant age-related difference in the bus air quality . . . breathing the air on Fairfax County Public Schools buses poses no health risks to our students and staff."[100] Other attempts at opposition to school bus DE reform have been aimed at specific legislation.

When the EPA announced its new DE standards for 2007, the regulations were challenged by the National Petroleum Refiner's Association (NPRA). A federal circuit court rejected their claim that the regulations were created "arbitrarily and capriciously," in regard to their looming 2007 deadline.[101] Other forms of opposition have emanated from diesel engine manufacturers, attempting to argue that diesel engines are not less-clean than alternative fuel engines.[102] Overall, in the face of current, successful efforts to clean school bus DE, opposition has been less than successful. Yet the relative failure of the opposition to school bus DE reform does not mean that further action to remedy school bus DE cannot or should not be attempted.

---

96. SERC, *supra* note 53.

97. *See* EPA, SUMMARY OF STATE ANTI-IDLING REGULATIONS (2003), *available at* http://www.epa.gov/otaq/smartway/documents/statelaws.pdf.

98. *See* SERC, *supra* note 53.

99. FAIRFAX COUNTY SCHOOL DISTRICT, A REPRESENTATIVE SAMPLE OF FAIRFAX COUNTY PUBLIC SCHOOL BUSES FOUND TO BE FREE OF SIGNIFICANT DIESEL EXHAUST –A- (2001), *available at* http://www.nasdpts.org/documents/Fairfax%20Bus%20Exhaust%20Report.pdf.

100. *Id.* at 2.

101. *See* Nat'l Petrochemical & Refiners Ass'n v. EPA, 351 U.S. App. D.C. 127 (D.C. Cir. 2002).

102. *E.g.*, STN, *Mixed Reactions Greet CARB's Resolution to Cleanse California of Diesel Trucks, Buses,* Dec., 1998, http://www.stnonline.com/stn/cleanschoolbus/csb_agencyactions.htm#.

VI. Potential Remedial Action

Every level of government, in most states, has taken initial steps against school bus DE. The question that remains is whether or not current remedial efforts are adequate. The UCS report indicates that every state can still severely decrease DE levels aboard their school buses. The average bus in the cleanest states still produces 20 percent more DE pollution per mile than "big rig" trucks.[103] In fact, the report indicates that DE pollution aboard school buses could be reduced by a factor of ten through new or existing technologies.[104] This would include either replacing existing school buses or applying retrofit technologies to the current fleet.

But whether school bus fleets replace current school buses or retrofit existing school buses, cleaning-up school bus DE still requires the necessary funding. It seems unlikely that additional federal funding will be provided in the future, since the federal government has already allocated funding through the EPA, and Congress never passed the "Clean Green School Bus Act of 2001." Also, the U.S. General Accounting Office reported in 2000 that purchasing alternative fueled transit buses would cost more than their "marginal effect" on air quality would be worth.[105]

Therefore the task of funding clean-up efforts has fallen squarely on the shoulders of the states. Yet for many states, providing the necessary funding can be a serious problem. In Texas, for example, most of the funding allocated for cleaning DE has gone towards the larger goal of mandatory compliance with the Clean Air Act.[106] States that are interested in fixing their school buses need the funding that will enable them to embrace new technology and fuels for their school buses.[107] Because of economic unbalances, the answer to the problem of funding these efforts will probably be different for each state, absent further federal funding.

Those states that have enough funding may create, or already have created, programs to clean-up their school bus fleets. For these states, proper legislation, leading to effective appropriation,[108] can begin the

---

103. UCS, *supra* note 54.

104. *Id.*

105. STN, http://www.stnonline.com/stn/cleanschoolbus/csb_faqs.htm (last visited Dec. 2, 2007).

106. *Morning Edition: Bus Exhaust Pits Health Worries and Cost Concerns* (NPR radio broadcast June 6, 2006), *available at* http://www.npr.org/templates/story/story.php?storyId=5453483.

107. Patricia Monahan, *School Buses Don't Make the Grade*, Catalyst, Spring 2002, at 7.

108. Adequate appropriation has not occurred in every state that has established a program. In Texas, the TERP fund and another DE pollution fund will reportedly hold an

process of school bus DE clean-up. For other states that do not have the necessary amount of funding, or where there is a lack of interest in funding DE clean-up, regulations that reform the practices of existing fleets may be a better answer, until funding can be provided. There are specific ways in which each level of government can improve its effort to clean the DE of America's school bus fleet, and in the meantime, there are ways in which each level of government can decrease DE exposure within the existing school bus fleet.

A. Federal Level

Although the EPA has created new emission standards for 2007 and provided some funding toward replacement and retrofits, there are additional steps the federal government might be able to take in order to decrease the health risks of school bus DE. One way would be to actually mandate retrofits and cleaner fuels. Although there are currently no federal standards for tailpipe emissions, tailpipe emissions substantially affect Ambient Air Quality (AAQ). Redrafting AAQ standards for each state with tailpipe emissions in mind could substantially change the amount of DE aboard school buses. The federal government could incorporate pollution levels *inside* vehicles into AAQ standards as well. This would help to curb the harmful effects of DE inside school buses themselves, where the greatest danger of DPM toward children lies.

Such extensive legislation seems unlikely, especially given the fact that the "Clean Green School Bus Act of 2001" was unsuccessful. Yet, since the EPA successfully implemented new emission standards for 2007, against some severe opposition, such an implementation might be successful. In any case, the federal government should implement new emission and/or idling standards, while simultaneously making additional funds available to ensure states' ability to comply.

Funding for cleaning-up school bus emissions should not lie solely on the shoulders of the federal government, but further aid is still needed by many states. The case is not that federal funding programs have been unsuccessful, only that further aid is needed to adequately solve the problem. Many states are financially incapable of cleaning-up their school buses, as they already strive to remain in compliance with the Clean Air Act.[109] Other states, like California, have made an admirable effort to address the danger of DE, but these states are a minority. The federal government needs to fund school-bus improvements in

unappropriated $100 million by the end of 2007. Therefore the money exists in Texas, but it has not been distributed as promised. ED, *supra* note 1.

109. *E.g.*, *id.*

conjunction with state funding programs.

B. *State Level*

One of the most helpful steps that state governments can take against DE exposure on school buses is to limit school bus idling times, since a substantial amount of DE exposure occurs through and during school bus idling. If the time during which school bus engines were running could be reduced, exposure to DE would be exponentially limited. Many states have proceeded with implementing anti-idling measures, but this is a simple step that every state can take against DE exposure.

States should also require retrofitting and cleaner fuels aboard their school buses. California has already accomplished this through CARB. Although such a measure would require additional funding for most states, some funding can still be gained from federal programs. If a state still cannot accumulate the necessary means to achieve the level of regulation that California has achieved, less expansive regulation may be a better option.

More routine maintenance and testing of school bus engines and tailpipes would be a large improvement in school bus transportation air quality. States could require school buses to leave their windows open while driving, in accordance with the recommendations of the various studies performed aboard school buses.[110] Since the federal government does not regulate tailpipe emissions or onboard DE levels, it is up to the states to set higher standards for themselves in order to ensure children's safety.

C. *Local Level*

The local level can also help to improve school bus emissions by encouraging smarter school bus practices. Although local funding is limited, school districts can take it upon themselves to limit dangerous practices, if their state has not taken the initiative to legislate. School districts and local governments should limit bus idling and ensure that buses with higher emission rates are running shorter routes and plan school bus routes in such a way as to limit the time children actually spend on school buses. More stringent maintenance standards should also be enforced, along with more frequent engine crankcase and tailpipe

---

110. Obviously, this might present a problem during certain seasons and weather conditions, and it could even pose additional safety risks. Those considerations are not being analyzed within the scope of this article; such a measure is recommended only for its effect of reducing DE exposure.

emission testing.

In addition to reforming current practices, localities can work in conjunction with state governments to create funding for school bus retrofits. Some localities have taken the initiative to clean up their school buses and have been rewarded for it by their state. The Texas Commission on Environmental Quality has decided to reimburse local governments in Texas for their efforts against school bus DE.[111] These localities have spent between $800 and $7,500 on each pollution control device used in their school buses. Although an initial strain on local budgets, successful lobbying and increased awareness encouraged the state to allocate $7 million toward state and local efforts directed against the hazards of school bus DE.

VII. Conclusion

Studies have proven the danger of DE, particularly because of the DPM contained therein. This danger exists in harmful amounts within school buses across America. This is specifically harmful to school children not only because of their frequency aboard school buses, but because of their particular physiology. The same studies have shown how and why DE permeates the interior of school buses throughout any given bus ride. The bottom line is that DE aboard school buses is a serious problem that must be addressed.

Although various levels of government have acknowledged the danger and responded to varying degrees, the current efforts to combat the rising problem of DE aboard school buses are largely inadequate. Major strides must occur at each level of government to regulate the use of the current school bus fleet and create programs that will fund the outfitting or replacing of the bus fleet with the necessary technologies that will make them safer for America's school children. Each level of government in most states has done well to acknowledge the problem. now they each need to go further and ensure that school buses all across America are safe for the children that depend on them daily.

111. Environmental News Service, http://www.ens-newswire.com/ens/nov2007/2007-11-12-095.asp (last visited Dec. 2, 2007).