Outdoor Air Pollution: An Issue for Schools

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Executive Summary

- Outdoor (ambient) air pollution presents a number of issues in the school environment, including exposure of children to diesel exhaust from older buses, potential risks for students who play or exercise outdoors on smoggy days, and exposure to emissions from nearby traffic and industrial facilities.

- The current asthma epidemic raises additional concerns since air pollution exacerbates and may cause asthma.

- There are a variety of ways to assess air pollution in the area surrounding the school and there are steps that school administrators can take to protect children and address pollution.

Outdoor air pollution continues to present a serious public health problem, especially for children, a vulnerable population (see Box 1). Exposure to air pollution, even at levels that the government currently allows, is linked to a variety of adverse respiratory health effects in children, among them decreased lung function, increased symptoms of and hospitalizations for respiratory illnesses, and aggravation of asthma. Because children (as well as teachers and staff) spend so much of their day at school, the air in that

[1] Available from publisher or http://www.amazon.com/Healthy-School-Environments-Howard-Frumkin/dp/0195179471

environment can affect their health. If the air pollution levels are high, precautions must be considered for children who are playing or exercising outdoors.

Travel to and from school can also present special concerns, as can school siting.

Box 1. Why Children Might be More Affected by Air Pollution than Adults

- They inhale higher relative doses (they breathe more air per unit of body weight).
- They have smaller diameter airways.
- Their lungs and immune systems are still developing.
- They spend more time outdoors.
- They are more active, especially in the afternoon, during peak hours of air pollution.
- They are closer to the ground level and sources of vehicle exhaust.

(Adapted with permission from Hricko et al. 1999; Schwartz 2004)

BACKGROUND

Ambient air refers to the outdoor air in a neighborhood or community, as opposed to the air inside buildings such as homes and schools. Children spend part of many school days outdoors, whether during recess or in walking between school buildings. However, outdoor air does not simply stay outside. It can get into a building through open windows and doors and penetrate in other, more subtle, ways, including through openings, joints, and cracks in walls, floors, and ceilings, and around windows and doors. (Scientists estimate that for certain pollutants, such as tiny particles, the levels of pollution outside a building account for about 25% of the indoor air pollution. Studies on ozone in California have found that ozone inside a building can reach 40% of the ozone levels outside.)

Air pollution in communities with high ozone levels is often referred to as smog. Two of the key constituents of smog are ozone and particles (particulate matter). Under the federal Clean Air Act, both ozone and particles are regulated, along with four other key pollutants: carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide. Other pollutants are found in the air from vehicle exhaust, road dust, fires, fuel combustion, industrial facilities, power plants, consumer products, and other sources. Some of these pollutants are considered air toxics and are subject to regulation.

Key Air Pollutants

Ozone

Ozone is formed by chemical reactions that occur primarily from the action of sunlight on hydrocarbons and nitrogen oxides emitted in fuel combustion. Studies have shown that ozone exposure is associated with reduced lung function, shortness of breath, chest pain, wheezing and coughing, asthma exacerbation and poorer athletic performance (Thurston and Bates 2003). Emerging evidence suggests that ozone exposure may even increase the risk of developing asthma (McConnell et al. 2002). High ozone levels are a problem in nearly 500 counties in 31 states, according to the U.S. Environmental Protection Agency (EPA 2004). Ozone levels vary by season and time of day. Levels are typically higher in the summer and early fall and lower in the winter; levels are higher in the mid to late afternoon than in the morning and evening.

Particulate Matter

Particulate matter (PM), made up of tiny specks of dust, soot, or aerosol in the air, can come from vehicle tailpipes, factories, refineries, power plants, ships, locomotives, planes, forest fires, dust storms, and other sources. The tiniest of these particles, called ultrafine particles, typically result from the combustion of fuel. When inhaled, ultrafine particles can deposit in the lungs and, in animal studies, have been shown get into the brain (Oberdorster et al. 2004). Particles may be dangerous in and of themselves, but they also have many harmful chemicals on their surfaces that can be carried into the body. New studies link particulate matter exposure to increased respiratory and cardiovascular illnesses and death, especially among the elderly and those with preexisting heart and lung disease (Pope et al. 2004) and diabetes (Bateson and Schwartz 2004).

Carbon Monoxide

Carbon monoxide (CO) comes from the combustion of fuel and is emitted by motor vehicles. Exposure to CO can alter the body's ability to supply oxygen to the organs, and at very high levels (such as from faulty venting of a gas heater) can result in sleepiness, unconsciousness, and death. CO levels are higher within 500 feet of busy roadways, according to studies done in communities with high traffic volumes (Zhu et al. 2002a, 2002b). Studies in Los Angeles, California, showed a relationship between CO levels (and other indicators of heavy traffic exposure) and both birth defects and low birth weight in babies of exposed mothers (Ritz 1999; Ritz et al. 2000).

Nitrogen Dioxide

Nitrogen dioxide (NO_2) results from chemical interactions in the air when nitric oxide (NO) is emitted by vehicles or through fuel combustion. NO_2 is a precursor of smog. NO_2 has been linked to a decrease in lung function growth and acute respiratory problems. It is unclear whether NO_2 causes these effects directly or whether it serves as a marker for other traffic-related pollutants. That is, there may be some other pollutant in traffic exhaust that is actually responsible for the health effects.

Sulfur Dioxide

Sulfur dioxide (SO_2) is emitted from industrial facilities such as power plants. Sulfur dioxide emissions are a problem particularly in Eastern and Midwestern states, where they have contributed to acid rain. Children with asthma may be especially sensitive even to low concentrations of SO_2 (ATSDR 1999).

Lead

Lead was a serious air pollution problem until its use in gasoline was finally phased out in the U.S. in the late 1970s. The average blood lead levels of children in the United States have dropped dramatically since that time—a public health success story. Today the main exposure sources for lead in the school environment are flaking lead-based paint, drinking water from systems with old leaded pipes, and contaminated soil. (See Chapter 15 for more information on these sources and on the health effects of lead.) However, some communities may have smelters, metal scrap recycling operations, battery manufacturing plants or other factories that emit lead. These sources are of particular concern, as lead emissions can contaminate the air, soil, and workers' clothes; health problems can result in children whose homes or schools are nearby or whose parents work at the plant and bring their work clothes home.

Air Toxics

There are also hundreds of different air toxics—toxic chemicals released into the air from local air pollution sources such as neighborhood dry cleaning shops, refineries, or automobiles. Several hundred of these compounds are regulated by the Federal Clean Air

Act. Air toxics are of concern because of their chronic (long-term) effects. In this chapter we discuss several air toxics that pose significant risk to children's health.

Health Effects of Selected Air Toxics

Diesel Exhaust

Diesel exhaust is emitted by diesel trucks, buses, cars, locomotives, ships, and a variety of off-road equipment. The health effects of diesel exhaust exposure include eye and respiratory irritation, asthma exacerbation, and increased cancer risk. Scientific studies also show that when people with allergies are exposed to diesel exhaust, they have increased allergic reactions, including allergic rhinitis (hay fever–like symptoms), and that the genes of some people make them even more susceptible to diesel exhaust (Gilliland et al. 2004). In animal studies, researchers have shown that breathing diesel exhaust particles may be enough to induce acute asthma attacks (Hao et al. 2003).

Dioxins

Dioxin and dioxin-like chemicals (including those generally referred to by their acronyms PCDDs, PCDFs, and PCBs) are produced during incomplete combustion of chlorine-containing wastes like municipal solid waste, sewage sludge, and hospital and hazardous wastes. Studies of workers link dioxin exposure to increased risk of cancer and animal studies have demonstrated reproductive effects (EPA 2003). The proximity of schools to incinerators or hazardous waste sites is of concern.

Polycyclic Organic Compounds

Polycyclic organic matter (POM) is a class of chemicals comprising 100 different compounds, including polycyclic aromatic hydrocarbons (PAHs) such as benzo-[*a*]-pyrene. Most of these chemicals are attached to particulate matter. They arise from combustion processes such as forest fires, wood burning, agricultural burning, smoking of tobacco, and vehicle exhaust. Children may be exposed in the school environment, as POM can get indoors from the outdoor air, especially at schools near industrial or agricultural operations or freeways.

Acrolein

Acrolein is produced from the combustion of fossil fuels, tobacco, and forest fires. It is a by-product of atmospheric reactions involving 1,3-butadiene from vehicle exhaust and is also an ingredient in certain pesticides. Animal studies indicate that acrolein exacerbates asthma.

Cigarette Smoke

Both POM and acrolein are constituents of tobacco smoke. School administrators, nurses, and teachers might consider discussing the toxic chemicals in cigarette smoke in antismoking educational programs at their schools and include efforts to get parents to stop smoking as well.

Health Effects of Key Air Pollutants on Children

We have known for years that breathing high levels of air pollution (ozone, particles, and other pollutants) can cause acute changes in health, such as nasal congestions, irritated eyes, coughing, chest tightness or congestion, wheezing, and the inability to breathe deeply. These short-term effects resolve when the person breathes cleaner air. Studies show the following:

- When ozone levels go up, the number of school absences due to acute respiratory illness increases (Gilliland 2001).

- When levels of ozone and particulate air pollution increase, children with asthma have more emergency room visits and hospital admissions (Peel et al. 2005).
- When air pollution levels decrease (e.g., during the Olympics in Atlanta when traffic was reduced, and during a period in Utah when steel mill workers were on strike), children's health improves, with fewer hospital visits and admissions for respiratory problems (Friedman et al. 2001; Pope 1996).

Less is known about the chronic effects of air pollution. For the past 10 years, researchers at the University of Southern California have studied the chronic effects of air pollution on the health of school children in the Children's Health Study (CHS). They have followed thousands of children who attend schools in more than a dozen different communities with differing levels and types of air pollution. Some of their key findings (summarized in Kunzli et al. 2003) are:

- Lung function growth is slower in school children living in communities with higher pollution levels. In fact, by age 18 a higher percentage of children who grew up in polluted communities with high levels of particles and NO_2 have underdeveloped lungs compared to children in low air pollution communities (Gauderman et al. 2004).
- Lung function grows more rapidly when school children move away from polluted communities to areas where particle levels are lower.
- Children with asthma have more bronchitis and persistent phlegm (mucous that makes them keep trying to clear their throats) when they live in more polluted communities.

- Children who play outdoor team sports and spend more time outside in high ozone communities have a higher incidence of newly diagnosed asthma. When the CHS looked at the students who exercised the most, those who played three or more sports and also lived in the communities with high ozone levels were found to have about a threefold increased risk of developing new asthma. By epidemiological standards, that is a very high risk (McConnell 2002).

Adults, especially the elderly and the ill, are also at risk of chronic health effects from air pollution. Studies show links between air pollution and lung cancer, and new concerns have also been raised about particle pollution and excess deaths from heart- or lung-related illnesses in older people and those who are ill.

Air Pollution and School Concerns

Health, economic, transportation, recreation, and urban planning concerns intersect around the issue of air pollution in the school environment.

School Absences

In the CHS, school absence rates increased as the levels of ozone increased. The study determined that nearly twice as many children are absent from school several days after the levels of ozone exceed state standards (Gilliland et al. 2001). This means that, as the air pollution gets worse, more children miss school. Further, when a young student misses school, someone typically misses work to take care of the sick child, meaning lost wages and lost productivity. An analysis of the CHS data calculated that reducing high levels of ozone could save approximately $67 million every year in Southern California alone in costs related to school absences, an average of $75 per year for every student.

For many school districts, fewer school absences would also mean more money in the school budget, as daily student enrollment is often linked to state funding. More significant is the fact that a child who misses school regularly because of illness can easily get behind in schoolwork and may suffer academically.

Air Pollution on the Way to School

The mere act of being transported to school, whether in a school bus or car on a busy highway or freeway, can create some of the worst air pollution exposures during a child's day. A California Air Resources Board (CARB) study found that levels of pollutants in cars can be very high during the busiest commute time on freeways with high traffic volume (Rodes et al. 1998). A study on air pollution inside North Carolina state police vehicles also found that pollution was higher inside cars than outside (Riediker et al. 2003). Another CARB-funded study concluded that school children who ride in conventional diesel-fueled school buses are exposed to high levels of air pollutants from the school bus diesel exhaust seeping into the bus cabin, as well as from outside traffic (Fitz et al. 2003).

Diesel exhaust (see fig. 1) is a concern because it is linked to both cancer and asthma. The CARB bus study found air pollution levels two to five times higher inside regular diesel school buses than in diesel buses equipped with particulate traps or in compressed natural gas (CNG) buses. The two most significant scenarios for high exposure to pollutants on buses occurred when the bus windows were closed (pollutant levels were several times higher than when the windows were open) and when the windows were open, and the bus was in traffic behind trucks or other buses (the pollutant levels inside the school bus were very high). Other children arriving at school and people at the school who were helping with loading and unloading the buses were exposed to diesel pollution as the buses arrived and departed. For the students commuting by bus, however, exposures inside the bus were much more significant than exposures that students experienced while getting on or off the bus or waiting to load.

Exhaust from gasoline-fueled cars and sport utility vehicles (SUVs) also contains hundreds of toxic chemicals harmful to health. Thus, school administrators should also be aware that the lineup of cars outside schoolyards during drop-off and pickup times can also create unusual amounts of air pollution. This is a particular concern in lower-income communities, where many of the cars are older and may not have appropriate pollution controls, or in more affluent communities where many of the cars are SUVs that pollute more than regular cars and have fewer air pollution restrictions.

School Exercise and Outdoor Sports Practice

Regular exercise is critical for the health of school-aged children. In the face of high levels of community air pollution, however, school administrators are faced with difficult decisions about exercise, whether for recess, physical education, band or cheerleading practice, or team sports (see fig. 2). Precautions need to be taken because children breathe harder when they exercise. In fact, exercising heavily increases ventilation rates (how many breaths per minute someone takes), which means breathing in a greater dose of airborne pollutants.

Air Pollution and School Siting

Only recently have scientists begun to consider what happens to the respiratory health of children who live or attend school near roads with heavy traffic. There is now compelling evidence that people whose homes or schools are close to busy roads have higher exposure to vehicle emissions than those who are farther away. For example, levels of ultrafine particles from vehicle emissions are 25 times higher right next to a busy freeway in Los Angeles than just 50 meters (165 feet) away (Zhu et al. 2002a, 2002b). Evidence also suggests that people in these situations may suffer adverse respiratory effects. In the Netherlands, studies of children living near major roadways found decreased lung function and increased respiratory illness, particularly related to high volumes of diesel truck traffic (Van Vliet et al. 1997). Dutch researchers also found that asthma is more often reported in children living within 100 meters of a freeway. Other scientific studies are now raising concerns about birth outcomes in mothers who live in high-traffic areas during their pregnancies, as an increase in premature births, certain birth defects, and even infant deaths have been observed (Kim 2004). The proximity of homes, day care centers, schools, parks, and playing fields to busy freeways and roads is an emerging issue that school districts, residents, and local planning officials must consider, especially when siting new schools. In addition, it is not just air pollution that is an issue; noise from busy roads close to schools can also impact learning.

Similarly, students and school staff may be at risk if a school is located close to a polluting factory. For example, chrome-plating plants next to homes and schools are coming under closer scrutiny, especially in low-income, minority neighborhoods. A chrome-plating plant next to a public school in downtown Los Angeles was the target of a 2004 lawsuit by the city attorney, who charged the facility with environmental contamination and cited environmental injustices. The chrome-plating factory, which was considered an inappropriate land use or zoning decision, was constructed after the school was built. In San Diego, California, a chrome-plating facility was shut down by the government after elevated levels of hexavalent chromium were found in adjacent homes. These actions were prompted by local residents, school staff, or parents of students who complained of respiratory and other illnesses. In each case, a community-based organization worked with the community to investigate the problem as an environmental justice issue, arguing that a polluting factory next to a home or school would not be allowed in a more affluent community (Environmental Health Coalition 2002).

Is There an Air Pollution Problem at the School?

To determine the types of outdoor air pollution problems a school may have, school administrators should be encouraged to form a committee to assess the problem. The committee would (1) investigate the levels of air pollution, the times of day during which the levels are highest, and nearby sources of pollution; (2) study students' transportation patterns; (3) conduct an inventory of the school bus fleet, and (4) determine what time of day outdoor practices are held for team sports, cheerleading, marching band, and other groups.

The regional air pollution district is a likely first stop in determining the levels of air pollution in the community. That agency's Internet site may allow a search for community air pollution levels to determine whether ozone is a problem there and whether there is a pattern of higher air pollution in the afternoon. Some communities also report area air pollution readings in the daily newspaper. At the national level, the EPA, through its AIRNow program, has maps showing current air quality and next day forecasts for selected communities (see the list of resources at the end of this chapter).

Conducting an informal inventory of roads and businesses within one-quarter mile of the school, where exposures might be greatest, is another valuable tool to asses the potential risks a school might face. If the school has regular staff meetings, this process might be started by simply sharing the following information:

- distance to closest busy roads (north, south, east, west)
- distance to other roads with a high volume of trucks or cars
- distance to the closest businesses, ports, rail yards, or factories
- information about the manufacturing (or otherwise polluting) processes at these sites.

At that point, if there are concerns, a committee could be formed to investigate further. For example, the local air pollution control authority may have information on emissions or violations from any of the identified facilities, and traffic counts may be available from the city's transportation department. High volumes of vehicles on nearby roads are of concern, especially when heavy-duty diesel trucks constitute a large percentage of the traffic. This information may be useful in determining routes that school bus drivers should avoid as air pollution inside buses can increase as a result of the outdoor traffic.

To identify industrial facilities that are large polluters, interested school personnel can turn to a number of databases. The EPA maintains the Toxic Release Inventory, which covers emissions of 650 toxic chemicals from facilities that emit significant amounts of the chemicals. The online U.S. EPA Envirofacts database (see the list of resources at the end of this chapter) allows Internet users to search for facilities and their emissions data by inputting the ZIP code of a school. Once the names of nearby facilities are obtained, the local air pollution control authority may be able to contribute additional information on emissions or violations. The Environmental Defense web site also has information on toxic releases (see resources). The Los Angeles Unified School District maintains a database of industrial facilities near schools (see resources). Finally, many states have their own databases that identify industrial facilities and their emissions of certain toxic chemicals, as does California with its Air Toxics Hotspots program (see resources). Once the school committee has identified these nearby fixed sources of pollutants, a qualified scientist should measure the levels of the pollutants of most concern at the school to better assess the impact of these emissions on the school's occupants.

Transportation services personnel may already have conducted an inventory of how students get to and from school. This is a useful assessment tool to determine how many students ride the bus, how many walk or bicycle, and how many come in private cars, and whether any take public transportation or other forms of transportation. An important addition to this assessment is an analysis of bus routes and the length of time that students are on the bus. This information will help to determine whether shorter bus routes are possible to reduce student exposure to diesel exhaust. Counting the number of students who come in private cars and taking photographs during morning drop-off and afternoon pickup times can help reveal problem areas. Alternative drop-off and pickup locations might be needed to reduce vehicle congestion and thereby decrease air pollution. School districts that are interested in encouraging more students to walk to school (after considering all the safety implications) might consult the KidsWalk-to-School web site of the Centers for Disease Control and Prevention or consider a Walk to School Day to jumpstart their program (see resources and chapter 22).

A valuable part of the transportation assessment is an inventory of school buses to document their age and the type of fuel they use. From this information, school authorities can decide how to prioritize funding decisions on school bus replacements or retrofits, beginning with the oldest (and most polluting) buses.

Address Air Pollution at Schools

What to Do on Bad Air Days

School personnel have a responsibility to take appropriate actions at schools when the air quality is expected to reach unhealthy levels, which typically occurs in large urban areas every year between the beginning of May and the end of September.

If the regional air pollution control authority has a program to notify schools of bad air days or to inform them of the Air Quality Index (AQI), the school should ask to be notified. (See Chapter 28 for a full explanation of the AQI.) If the region does not have such a program, schools can try to work with the agency to develop one or establish a useful way to notify parents, students, teachers, coaches, school nurses, and other school personnel about air quality concerns (see box 2).

Box 2. ASTHMA-FRIENDLY FLAG PROGRAM

In 2004, the Merced/Mariposa County (California) Asthma Coalition developed an "Asthma-friendly Flag Program." The purpose of the program is to reduce or limit students' exposure to poor air quality, especially during outdoor sporting activities. The program is based on the U.S. EPA's AQI color code, with green flags denoting good air quality; yellow, moderate air quality; orange, unsafe for sensitive populations; and red, unhealthy for everyone. Each day schools raise the appropriate colored flag based upon the air pollution control district's air quality forecast, which is sent by e-mail to schools the day before (around 4 PM). Individual school districts determine who within the school receives the e-mail alert and ensures the appropriate flag is raised. For example, in one district this could be the safety control officer, and in another district it could be a vice principal, who then instructs maintenance or grounds personnel to raise the flag. Schools are responsible for having alternative activities in place on orange and red days on which it is advisable to limit or forego outdoor activities. (Because obesity is a countywide concern, schools are encouraged to have in place active indoor alternatives to sporting activities.) In 2004, Merced and Mariposa counties experienced 114 orange days and 7 red days. By early 2006, 95 schools in Merced County and three hospitals were displaying the flags, and the program had been replicated in numerous California counties, by school districts, chapters of the American Lung Association, and other asthma coalitions. The flag program has been recognized across the state, where more than 500 schools now use it, and it has been endorsed by the California Department of Health Services and the Environmental Protection Agency as a "best practice" for schools.

(Interviews with Alicia Bohlke, June 16, 2004, and Mary Michal Rawling, January 10, 2006, staff of the Merced/Mariposa County, California, Asthma Coalition)

On days with bad air quality, one precaution is to keep the windows closed. Another is to ensure that the school's ventilation system is working effectively (see chapters 5 and 10). Ideally, schools in high ozone or high particle communities will have air-conditioning. In addition, schools can schedule outdoor activities in the early morning to minimize ozone exposure. Coaches and teachers should pay special attention to students on bad air–quality days to detect early respiratory symptoms.

School Siting

New legislation in California addresses the issue of siting new schools along heavily traveled corridors. The legislation bans new school construction within 500 feet of busy roads and freeways, although it does not address the 200 California schools already built within 500 feet of a freeway.

The California Office of Environmental Health Hazard Assessment (OEHHA) has suggested ways to reduce the exposure to students and staff at schools near dense traffic areas, including ensuring that recreational areas and playing fields are located as far as possible from busy roads; avoiding exercise during rush hour; installing and regularly maintaining air-conditioning systems; installing portable air-conditioning units; and using HEPA filters at schools with the most serious exposures. The OEHHA plans to issue guidelines for better protection of students at schools near busy highways (see resources). As dense traffic often goes hand in hand with noise, school administrators should demand that sound walls be built to protect children from excessive traffic noise, which distracts them from their school work and interferes with student–teacher communication.

Retrofitting and Replacement of Diesel Buses

Some school districts have successfully retrofitted school buses with particulate traps to capture the particle pollution or replaced large numbers of old diesel buses with new or alternative fuel buses. An often-cited case study is a school district in Ardmore, Pennsylvania, that started to replace many of its diesel buses with CNG buses in 1995 (see box 3). By 2004, 75% of the school bus fleet in Ardmore consisted of CNG buses. The director of pupil transportation services reports that the state environmental protection agency is pleased with the pollution reductions the school district is achieving and that CNG buses have been well received by drivers, even though the buses have required somewhat more maintenance. He reports that one of the biggest challenges is finding the money to build the two refueling stations, which cost $350,000 each (Michael Andre, Ardmore, Pennsylvania, personal communication, February 2004). Interim steps in reducing diesel exhaust are to shorten bus routes to reduce commute time, use the cleanest buses for the longest commutes, decrease bus caravanning, and decrease idling time.

Box 3. Case Study: Lower Merion School District and CNG School Buses

Ten years ago, neighbors were complaining about noise and pollution from diesel buses at the school district's bus yard, which was located in a residential neighborhood. The Lower Merion School District (LMSD) in Ardmore, Pennsylvania, decided to begin a replacement program of CNG buses for older diesel buses, using state and other grants to buy them and build refueling stations. As of February 2004, the LMSD fleet contained 107 buses, 72 of which were operating on CNG. According to the head of pupil transportation services, the program has been well received, the complaints of residents have stopped, and the state environmental protection agency is pleased with the pollution reductions achieved.

(Natural Resources Defense Council 1998; Michael Andre, supervisor, Student Transportation Services, Lower Merion School District, Ardmore, Pennsylvania, personal communication, February 2004).

Box 4. Protecting against Diesel Exhaust Exposure from School Buses

- Develop a priority schedule, replacing the oldest buses with new low-emission buses.
- Consider buses that use alternative fuels such as compressed natural gas.
- Retrofit older buses with particle traps.
- Study commuting routes and try to shorten commute time.
- Use cleanest buses on the longest trips.
- When weather permits, keep the windows open on the buses.
- Limit or eliminate school bus idling.
- Invite bus drivers into the school in cold weather so they do not idle the buses to stay warm.
- Change bus schedules so buses do not caravan.
- Encourage drivers to maintain a good distance behind diesel trucks and buses.

Adapted from U.S. EPA Clean School Bus USA web site (see resources).

Idling Restrictions

Many school districts, cities, and states have regulations that limit idling time for school buses. The school district or state air pollution enforcement agency may already have an anti-idling rule. The California Air Resources Board has adopted a measure to eliminate unnecessary idling of school buses at or near schools (see resources). These rules state that the bus driver must turn off the engine upon stopping at a school or within 100 feet of a school and must not turn the engine on more than 30 seconds before departing from a school or from within 100 feet of a school. In addition, the driver cannot idle the bus for more than 5 minutes at any location greater than 100 feet from a school. This regulation might be a starting point for a school district's discussions on idling restrictions.

Educational Campaigns

In the interim, several educational measures can be considered. In May 2002, the State of Maine Departments of Education and Environmental Protection sent a letter to Maine public school superintendents statewide warning them of the adverse health effects caused by exposure to diesel exhaust and recommending diesel emission reduction strategies. The following month, a pledge card and magnet were given to school bus drivers as a reminder to turn off engines in the schoolyard and limit morning warm-up time whenever possible. (For more information on these programs, copies of the Maine letter, and the informational campaign materials, see the U.S. EPA Region 1 web site listed in the resources section.)

Air Conditioning

Chapter 10 addresses indoor air in schools, including good ventilation and filtration systems. However, because outdoor air finds its way inside, the following is a good frame of reference: If the air quality is good, open the windows unless noise levels are a problem. If the air quality is bad, keep the windows closed. Air conditioning definitely reduces the levels of ozone in the air and is recommended for schools in communities with high levels of air pollution.

Checklist for School Administrators

To address outdoor air pollution, school administrators can take the following steps:

- Limit outdoor activities on high ozone days. Keep students indoors for recess and practices. Ideally, cancel late afternoon practices or switch practices to the morning.
- Protect students from nearby industrial facilities, busy roads, and ports, by at least ensuring that school recreational facilities are located on the school grounds as far as possible from these sources of pollutants.
- Contact the air pollution control authority with any concerns about sources of pollution very close to your school, and discuss the record of the polluting facility. If there are violations, voice your concerns.
- Demand sound walls and other mitigation measures (such as soundproofing and double-pane windows) to protect against excessive noise from nearby airports, roads, or businesses.
- Consider switching to non-diesel school buses or retrofitting existing buses.

- Work with bus drivers to shorten bus routes, use cleanest buses for longest commutes, decrease bus caravanning, and develop other ideas for limiting exposure to diesel exhaust.
- Enforce idling restrictions for cars and buses in front of schools.
- Consider air-conditioning at schools where air pollution levels are high, especially those that conduct summer sessions.

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RESOURCES

A Breath of Air: What Air Pollution is Doing to Our Children. Educational video about air pollution's health impacts on children, summarizing the results of the Children's Health Study (28 minutes). Produced by the Southern California Environmental Health Sciences Center and Annenberg School for Communications, University of Southern California. 2003. Available in Spanish and English versions. Free. http://www.arb.ca.gov/research/health/school/school.htm.

California Air Resources Board site on school bus idling regulations http://www.arb.ca.gov/regact/sbidling/revfro.doc.

California Air Resources Board site on Air Toxics Hotspots Program http://www.arb.ca.gov/ab2588/ab2588.htm.

California legislation on school siting: See fact sheet at http://www.leginfo.ca.gov/pub/bill/sen/sb_0351-0400/sb_352_bill_20031003_chaptered.pdf

California Office of Environmental Health Hazard Assessment. Forthcoming guidelines on reducing exposure to air pollution for students and staff at schools near busy roads: http://www.oehha.ca.gov/

Centers for Disease Control and Prevention KidsWalk-to-School Web site: http://www.cdc.gov/nccdphp/dnpa/kidswalk/

Environmental Defense Web site on toxic chemicals in your community's air: http://www.scorecard.org

U.S. EPA AIRNow program with air quality forecasts: http://www.epa.gov/airnow/

U.S. EPA Clean School Bus USA Web site: http://www.epa.gov/cleanschoolbus

U.S. EPA Envirofacts Web site, including information on accessing the Toxic Release Inventory database: http://www.epa.gov/enviro/html/tris/tris_query.html

U.S. EPA Region 1 Web site on retrofitting diesel school buses: http://www.epa.gov/ne/eco/diesel/school_buses.html#sarsbi

Los Angeles Unified School District. Industrial facilities near LAUSD schools http://www.lausd-oehs.org/industrial.asp

Natural Resources Defense Council Web site with report on alternatives to diesel fuel: http://www.nrdc.org/air/transportation/ebd/chap6.asp

Office of Environmental Health Hazard Assessment (information on five air toxics and their effects on children): http://www.oehha.ca.gov/public_info/facts/airkids.html

Walk to School Day to jumpstart the program: http://www.walktoschool-usa.org/.

With Every Breath: Health Effects of Smog. Twenty-minute educational video produced by the California Air Resources Board. 2004. Available in Spanish and English versions. Free. To order, visit http://www.arb.ca.gov/research/health/school/school.htm

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