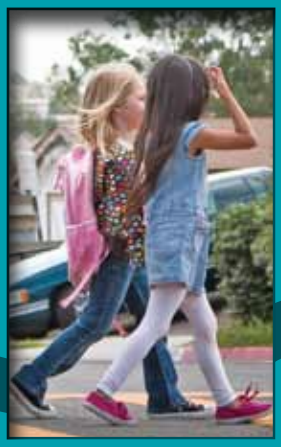
SAFE ROUTES to School
NATIONAL PARTNERSHIP

Safe Routes to School and Traffic Pollution

Get Children Moving and Reduce Exposure to Unhealthy Air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The National Partnership's mission is to advocate for safe walking and bicycling to and from schools, and in daily life, to improve the health and well-being of America's children and to foster the creation of livable, sustainable communities. The National Partnership is hosted by Bikes Belong Foundation, a 501(c)(3) non-profit which is a sister organization to Bikes Belong Coalition.

For more information, please visit ***www.saferoutespartnership.org.***

The Safe Routes to School National Partnership was founded in 2005 and is a fast-growing network of more than 550 groups working to set goals, share best practices, leverage infrastructure and program funding and advance policy change to help agencies that implement Safe Routes to School programs across the nation.

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The Safe Routes to School National Partnership and Consulting for Health, Air, Nature, & a Greener Environment, LLC (CHANGE) collaborated to write this resource guide to ensure it included perspectives on air quality, children's health and Safe Routes to School. Authors include:

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Introduction

The trip to school has changed dramatically in the past 40 years. Instead of streams of children walking and bicycling to and from school, today school administrators struggle to manage a back-up of cars and buses, with time-pressed parents and bus drivers trying to drop off children at the school entrance. Approximately 45 percent of children today are driven to school by their parents and 39 percent ride school buses, which costs school districts and families billions of dollars in gasoline each year. And, just 13 percent of children in the United States ages 5 to 14 walk or bicycle to and from school—down from nearly 50 percent in 1969.[1] In addition, each year more than 250 children are killed and approximately 23,000 are injured when they are struck by cars while walking and bicycling.[2] These deaths and injuries cost hundreds of millions of dollars annually in medical costs and work-loss costs.[3]

The federal Safe Routes to School program seeks to reverse these trends and get more children to safely walk and bicycle to and from school. Through the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) federal transportation law, Congress has provided approximately $1.1 billion for Safe Routes to School since 2005. The vast majority of funds are spent on infrastructure improvements near schools, such as sidewalks, paths, crosswalks, school zone signage and traffic calming. A small share of funding is for programs to teach children traffic safety skills, traffic enforcement around schools and encouragement activities.

The low-cost infrastructure improvements, such as sidewalks, crosswalks, school zone signage and traffic calming, made through Safe Routes to School can reduce traffic deaths and injuries. For example, adding a sidewalk reduces the risk by more than 50 percent that a pedestrian will be struck by a car.[4] These types of safety improvements can also help school districts manage school busing costs by reducing the necessity of busing children due to traffic hazards. And, by getting more children walking and bicycling, Safe Routes to School initiatives can reduce traffic congestion around schools and increase children's physical activity levels, which is critical for reducing the health care costs associated with obesity.

Clearly, there are strong benefits to implementing a Safe Routes to School program. Practitioners also need to understand and address possible risks to children from seeking to increase their rates of walking and bicycling to school. One potential area of risk is exposure to traffic-related air pollution (called traffic pollution in this report), but it has been under-examined thus far. This publication seeks to narrow that knowledge gap by examining the following:

- The health impacts on children from exposure to traffic pollution
- How Safe Routes to School programs can potentially impact children's exposure to traffic pollution
- Strategies and practice approaches that can mitigate exposure to traffic pollution

Because Safe Routes to School focuses on increasing walking and bicycling, thereby decreasing the number of vehicles around schools that are emitting traffic pollution, there is a natural link between efforts to increase walking and bicycling and efforts to reduce traffic pollution. However, it is important for Safe Routes to School practitioners to be aware of the complexities of how traffic pollution works so that they can minimize children's exposure.

Some air quality strategies and practices are relatively simple to incorporate into Safe Routes to School programs, such as school district no idling zones or selecting low-traffic routes for the walk route to school. Other practices, such as retrofitting school buses with cleaner burning fuels or siting schools within neighborhoods will require greater resources and leadership. It is our hope that this resource guide will help Safe Routes to School practitioners be more intentional about reducing the potential risks of exposure to traffic pollution so that participating children and families can be physically active in cleaner air.

The Basics of Traffic Pollution and Children's Exposure

Traffic is a major source of outdoor air pollution. Traffic pollution is a combination of many different types of compounds that are emitted into the air when fossil fuel (gas or diesel) is burned as a vehicle accelerates or idles. Higher concentrations of traffic pollution are typically found near the roadway. As a result, these higher concentrations can affect those driving or riding in cars and buses and those walking or bicycling on sidewalks or bike lanes next to the road.

Common types of traffic pollution include particle pollution, such as fine and ultrafine particulate matter; nitrogen oxides (NOx); hazardous air pollutants (HAPs), including carcinogens such as benzene and formaldehyde; volatile organic compounds (VOCs); carbon monoxide (CO); and polyaromatic hydrocarbons (PAHs). In addition, two of these types of traffic pollutants, nitrogen oxides and volatile organic compounds, produce ozone (O_3) when they mix in the presence of sunlight. *[See page 8 for additional information.]* Results of scientific studies have shown that short- and long-term exposure to these emissions may cause adverse health effects, particularly in sensitive populations, such as children, the elderly, low-income populations and individuals with pre-existing medical conditions including asthma or cardiovascular disease.

Researchers have come to these findings through a variety of studies that attempt to better understand how people are exposed to traffic pollution. Researchers often track people using various types of personal exposure monitors. These monitors measure the amount of pollution people are exposed to as they travel around in their daily lives. Depending on the study design, researchers may also collect pollution data at fixed locations throughout the study area. This allows the researchers to measure pollution levels in different areas and then compare these measurements with those from the personal exposure

At the simplest level, a person's exposure to traffic pollution is determined by the concentration of pollutants (with higher pollutant levels generally occurring closer to high-traffic roads) and the length of the exposure. However, the studies are complicated. It is difficult for researchers to separate exposure to traffic-related air pollution from exposure to air pollution from a variety of other sources, such as power plants or industrial factories. Plus, other factors, such as how the traffic pollutants disperse, wind patterns and weather, plus volume and flow of traffic, all affect the extent of exposures over time.

Specific to the trip to school, there are many variables that make it difficult to determine whether children walking or bicycling to school are more or less prone to traffic pollution exposures. For example, car or bus rides to school during traffic congestion can mean that children spend a longer time riding than they would walking or bicycling, which increases the exposure for the children in the car or bus. For children walking or bicycling, parents may choose a route to school that is a bit longer, but uses trails away from roads or low-traffic side streets for the trip, which reduces exposure to traffic but may increase the length of the trip. In spite of these complexities, it is clear that traveling in less congested areas via any mode of transportation can be helpful in reducing unnecessary exposures to traffic pollution.

Techniques to lessen exposure to traffic pollution focus on one of two approaches:

- Decreasing the concentration of pollutants
- Reducing the duration of the exposure

Within these two approaches are many tactics. Reducing the number of drivers on the road by encouraging them to shift trips to walking, bicycling or mass transit (or school buses) can decrease the concentration of pollutants. Asking drivers to shut off their cars or buses instead of idling at school can also decrease traffic pollution. Selecting lower-traffic routes, whether walking, bicycling or driving, means less exposure to the more concentrated pollutants along busy roads. Because children are exposed to traffic pollution whether they are sitting in a car or a bus, or walking or bicycling, many efforts to reduce exposure to and the concentration of traffic pollution will benefit all children on the trip to and from school, regardless of their selected way of getting to school.

Components of Traffic Pollution

Fine particles: Particles created by combustion sources typically from diesel fuels. They are formed from other smaller particles that combine to create larger particles as they are dispersed away from the roadway. Studies have found fine particles at specific mass concentrations to be correlated with adverse health impacts.

Ultrafine particles: Particles formed from combustion of fuel typically found to be very high in number concentrations closer to the roadway. These particles can combine together to form larger particles as they disperse away from the roadside. They are smaller than fine particles and there is more concern over the number of particles, but research on what number concentration can be correlated with health impacts is unknown.

Nitrogen Oxides (NOx): Gaseous pollutants created through combustion of fuel. Fuel combustion emits nitrogen oxide, which reacts with ozone to form nitrogen dioxide. Nitrogen dioxide has been shown to cause adverse health impacts under different exposure conditions with sensitive subjects.

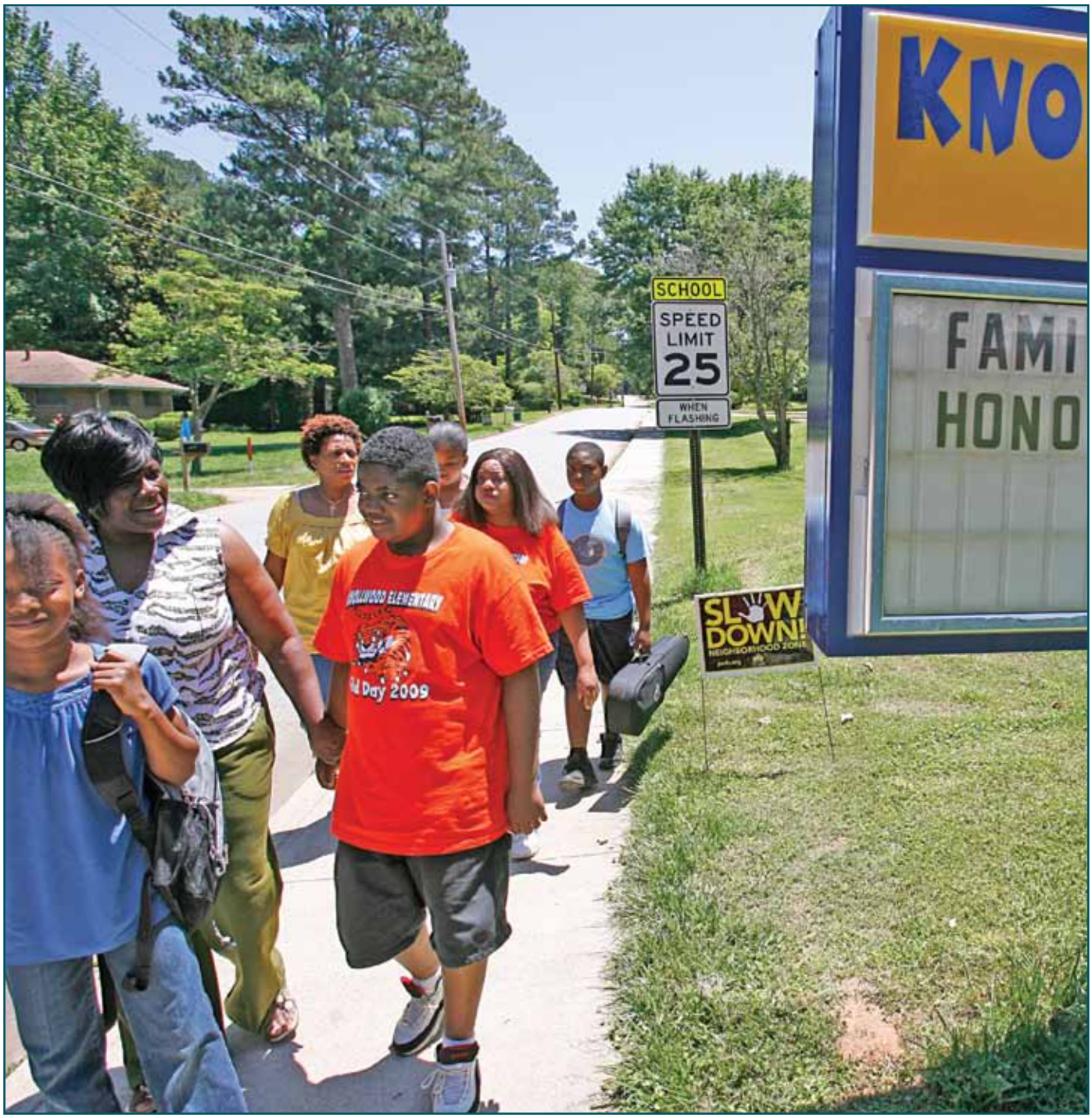
Hazardous Air Pollutants (HAPs): Toxic air pollutants, also known as hazardous air pollutants, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. The US EPA works with state, local and tribal governments to reduce releases of 187 pollutants to the environment, some of which are associated with traffic pollution.

Volatile Organic Compounds (VOCs): Gaseous pollutants emitted during combustion of fuel. These compounds are highly volatile and tend to evaporate readily. At greater distances away from the roadside, they tend to be very low in concentrations.

Carbon Monoxide (CO): Colorless, odorless, gaseous pollutant generated from fuel combustion.

Ozone (O_3): Gaseous pollutant associated with traffic. Ozone is formed at ground level primarily when volatile organic compounds and nitrogen oxides combine in the presence of sunlight.

Polyaromatic Hydrocarbons (PAHs): Gaseous pollutants emitted as a result of fuel combustion. These pollutants consist of several different types of compounds.


SCHOOL
SPEED LIMIT 25
WHEN FLASHING
SLOW DOWN!
Day 2009

The Scientific Evidence: What We Know About Traffic Pollution, Physical Activity and the Impact on Children's Health

The Health Risks of Exposure to Traffic Pollution and Disproportionate Effects on Lower-Income Schools

Traffic pollution studies typically involve measuring and/or modeling a selection of traffic pollutants to better understand the amount of pollution and the potential health impacts from various concentrations and length of exposures. In the past few years, several epidemiological studies have linked exposure to traffic pollution with different health effects in children.

Table 1. Traffic volume based on vehicles per day and relative correlation to low, medium or high traffic counts

Total Vehicles per Day	Traffic Count Designation
0-25,000	Low
25,0000-45,000	Medium
45,000 or more	High

Studies have shown that children who live near busy roadways tend to have increased exposures to various levels of traffic pollution and negative impacts on their respiratory health. While the definitions of what constitutes a busy roadway often differs across studies, researchers generally consider major roadways to be those with a steady stream of traffic throughout the day, as opposed to roadways that only have higher volumes a few times a day during peak travel. See Table 1 for an approximation of how vehicle counts relate to road volume. Studies assessing exposures to children living closer to roadways have found increased exposures to various traffic pollutants, such as nitrogen dioxide,[5]

ultrafine diesel particles,[6] carbon monoxide[7] and fine particulate matter.[8] Other mobile-source air-toxic pollutants, such as volatile organic compounds and various potentially carcinogenic compounds, have been shown to be elevated near roadsides, under heavy traffic conditions.[9,10,11]

Health effects can include short-term symptoms like a chronic cough or bronchitis, the exacerbation of existing illnesses like asthma or long-term effects on overall lung function.[12] Gauderman et al. (2004) found that children exposed to nitrogen dioxide and fine particulate matter had daily symptoms as well as a significant decrease in lung function and growth. Since lung development is nearly complete by age 18, children with lung deficits are likely to have diminished lung function for the rest of their lives.[13] These findings showing a negative health impact of exposure to traffic pollution are consistent with studies across a range of traffic pollutants, including fine particulate matter,[14,15,16] ultrafine diesel exhaust particles,[17,18,19] nitrogen dioxide[20,21,22] and carbon monoxide.[23,24] Results from some recent studies have shown that exposures to near-roadside polyaromatic hydrocarbons have caused elevated asthma symptoms, including in children riding school buses.[25] A study by Gehring et al. (2010) showed that children exposed to fine particulate matter and nitrogen dioxide in the first eight years of life had a significant increase in the prevalence of asthma and of asthma symptoms.[26]

Researchers also have honed in on the pollution dangers children—particularly lower-income children—face when at school. A study assessing inner-city schoolchildren via personal exposure monitoring of schoolchildren with asthma showed that exposures to fine particulate matter increased same-day wheezing, shortness of breath and total symptoms.[27] A national study found that approximately one in three U.S. public schools are located in "air pollution danger zones" within a quarter-mile or less of highways.[28] A similar study of California schools found that 9.5 percent of schools were located within 450 feet of roads carrying at least 25,000 vehicles per day.[29]

The same California study also found that schools with higher levels of exposure to traffic were schools that disproportionately served economically disadvantaged and non-white students. Similar findings were reported in a study of Wayne County, Detroit, Michigan. The results showed 7.2 percent of schools were located in high-traffic areas and that more traffic exposure correlated with lower-income and minority populations.[30] Looking abroad, studies in Canada[31] and in Europe[32] have also found that lower-income individuals live in and attend schools in neighborhoods that are located closer to busy roadways.

The Positive Impacts of Physical Activity

Today, more than 23 million children and adolescents in the United States—nearly one in three young people—are either obese or overweight.[33] The obesity rate today remains more than four times higher among children ages 6 to 11 than it was 40 years ago. During the same period, the rate has more than tripled for adolescents, ages 12 to 19 years.[34] Obese children are at higher risk for a number of serious health problems, including high cholesterol, high blood pressure, type 2 diabetes and asthma.[35] Obesity is also a significant cause of health care expenses, with approximately one-quarter of health care costs in the United States attributed to obesity-related health problems.[36]

A lack of physical activity is one of the major contributors to overweight and obesity. Just one-third of children are getting the U.S. Department of Health and Human Services' recommended level of 60 minutes of moderate-to-vigorous physical activity per day.[37] Walking and bicycling is one way to get physical activity, and walking or bicycling to school offers an effective way to build more physical activity into children's lives. One evaluation study found that two small lifestyle changes, for example eliminating 100 kcal per day from the diet and walking an additional 2,000 steps per day, can help address childhood obesity by preventing excess weight gain.[38]

A number of studies have documented the impact of walking and bicycling to school on children's physical activity levels and health. The results of these studies have shown that children who walk to school are significantly more physically active throughout the day[39] and have better cardiovascular fitness than children who are driven to school.[40,41] A recent study found that children who walked or bicycled to school had lower body mass index (BMI scores) and higher levels of moderate-to-vigorous physical activity.[42]

Weighing the Benefits and Risks

There is very little research presently published that would allow for an assessment of whether the benefits of physical activity from walking or bicycling in areas of high traffic pollution outweighs the risks. One study has shown that different types of commuter modes of transportation, such as bicycling, cars and buses, each have different exposure levels to various traffic pollutants. Results showed that bicyclists riding on roads typically inhaled more ultrafines due to higher respiration rates than those riding in cars and buses, but the concentration of fine particulate matter was similar across all modes of transportation.[43]

There are also a few studies using scientific modeling, where researchers use available data and simulate the possible results, or estimates, in this area. However, modeling studies are more general in nature, often look at average conditions over a broader area and are not a substitute for direct measurements and experiments. For example, a recent modeling study of six states in the Midwest (Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin) looked at the simulated impact of shifting one-half of all car trips of less than five miles to bicycling. The model predicts that the improved air quality resulting from less traffic pollution combined with the increased physical activity would result in health care savings of approximately $8.7 billion per year in the Midwest.[44] While a modeled study like this suggests that the health benefits of increased physical activity outweigh the health risks of increased exposure to traffic pollution across a large population, they are not specific enough to take into account the various factors that impact an individual's specific risks and benefits.

In the Netherlands, researchers examined the literature on air pollution, traffic crashes and physical activity, and applied it to a hypothetical situation in which citizens switched from driving to bicycling for short trips. They found, on average, that there were substantially larger physical activity health benefits from bicycling as compared with risks associated with exposure to air pollution and vehicle crashes.[45] While these results are promising, it is a study estimating risks based on broad population, health and geographical information, which does not mean that the health benefits outweigh the risks for everyone in the Netherlands.

Although there is limited evidence weighing the risks and benefits of being physically active in high traffic areas, many of the studies referenced in this section demonstrate adverse health impacts for children exposed to traffic

pollution. Therefore, Safe Routes to School practitioners should assume that walking or bicycling near busy roadways can lead to increased exposures and inhalation of traffic pollutants among school children. The health effects of exposure to traffic pollution would likely be stronger and more pronounced in children who have asthma or other respiratory conditions and may result in making current symptoms worse.

To truly know if the air pollution risks outweigh the benefits of children walking and bicycling, there are many research gaps that need to be addressed. Currently, there is virtually no research that uses real-time, actual measurements of traffic pollution combined with physical activity measurements and short- and long-term outcome data to determine whether it is healthier overall to reduce physical activity levels, or to be physically active in areas with higher traffic pollution levels. And the studies that do exist are about adults, making it difficult to understand how impacts may vary for children. The lack of real-time monitoring data also prevents a deeper understanding of the levels of exposure to traffic pollution depending on the route selected, different weather and air conditions, different times of day and the behaviors of different kinds of pollutants. These gaps also make it difficult to better understand the health effects on an otherwise healthy child as compared with an obese child or a child with asthma.

These data limitations create difficulties in making broad pronouncements about the health benefits and risks of walking and bicycling near high-traffic areas. Even with these limitations, there is enough evidence available about traffic pollution and its effect on health to allow families to make smart decisions about where to bicycle and walk, and for Safe Routes to School practitioners to implement strategies and practices that limit children's exposure to traffic pollution.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Strategies and Practices to Reduce Exposure to Traffic Pollution

This section outlines several strategies and practices that can help reduce levels of traffic pollution or limit a child's exposure to traffic pollution. Armed with the knowledge in this guide, Safe Routes to School practitioners can seek to implement variations on these examples as a means of encouraging healthy and safe walking and bicycling to school that is also cognizant of traffic pollution.

As discussed earlier in this guide, the ways of mitigating exposure to traffic pollution are to either decrease the concentration of pollutants or the length of the exposure. The strategy and practice ideas included in this guide reduce exposure to traffic pollution in one of three key ways:

- Diminish traffic pollutants by either reducing the number of cars, trucks and buses around schools, their pollution output or their idling time
- Limiting children's exposure to traffic pollution by choosing lower-traffic, lower-polluted routes or trails to walk or bicycle along
- Reducing the length of the trip to school by carefully choosing school sites near the neighborhoods where children live

Most of these strategy and practice solutions also have other benefits that coincide with Safe Routes to School. For example, reducing traffic volumes or encouraging children to walk along lower-traffic routes has a safety benefit. And, locating schools near the neighborhoods where children live increases the likelihood that more children will walk or bicycle due to the shorter trip.

Each section is organized by the strategy or practice topic and includes an overview of the issue, its potential impact on reducing exposure to traffic pollution and ideas for how to implement solutions within a Safe Routes to School program. Examples are provided from the United States and other countries to illustrate how the strategy or practice could be implemented. Each topic also includes a list of websites for more information.

Choosing lower-traffic routes for walking and bicycling

In general, traffic pollution is higher closer to roadways and highest on the road itself. In addition, busier roads with more cars have higher pollution levels. Armed with that basic and simple knowledge, parents and children have the power to select routes for the trip to school that have less exposure to traffic pollution. If there is a choice between a bike lane on the road or a sidewalk with no separation from the road versus a trail that is located away from the road, parents who want to reduce traffic pollution should choose the trail as it will result in less exposure to the pollutants that are most concentrated on or immediately next to the road. Or, when planning the route to school, parents should opt for low-traffic neighborhood streets rather than a main road with a high traffic volume, since the busier roads have higher levels of pollution.

While it is easily understandable that busier roads have more pollution, the effect of distance from the road on pollution levels can be complex. Numerous studies have looked at the levels of traffic pollutants near roadways. The concentration of traffic pollutants typically decrease as they disperse downwind and away from the roadway. Typically within 350 meters (1,050 feet) to 500 meters (1,500 feet), traffic pollutants are very low in concentration. The large decrease in the traffic pollutants away from the roadway assumes that there are no other roadways or mobile sources within the short distance that would result in other traffic pollutant increases of these pollutants, which would make it difficult to assess decreases in traffic pollutants. Within one-third of a mile from the roadway, nearly all traffic pollutants are indistinguishable from overall air pollution levels.[46]

Researchers in Portland did real-world experiments comparing bike lanes on the road with cycle tracks, in which the bike lane is separated from the road by a 10-foot-wide lane of parked cars. They found that the cycle tracks had anywhere from 10 percent to 40 percent lower counts of ultrafine particulate matter, partly from the extra feet of separation from traffic and partly because the cars served as a shield for the bicyclists.[47] While each type of traffic pollutant varies somewhat in how far it spreads away from the road, clearly the further the distance from the road the better from a traffic pollution perspective. But, even small distances of separation can make a difference for some types of pollutants.

While parents could make these decisions about selecting lower-traffic routes or trails away from traffic, Safe Routes to School programs could make those decisions easier. Many Safe Routes to School programs already produce

route maps identifying safer routes for walking and bicycling to school. These maps often point out sidewalks, crosswalks, crossing guards and residential streets with less traffic, as all of these aspects make the route safer. It would be fairly easy to modify these maps to also mark routes that would be healthier from the air quality perspective. Many of these would likely overlap routes that are safer from a traffic analysis as well. Safe Routes to School practitioners can look to their city or county public works officials or their metropolitan planning organization for information about traffic counts on local roads.

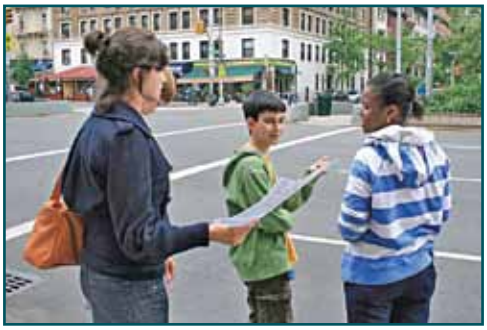
Simply adding a little information to the map, such as marking trails and lower-traffic roads and indicating they generally have less pollution, would help parents make informed decisions when planning the trip to school. While some of these walking and bicycling routes may be less direct, parents may find the additional time worthwhile to safeguard their children's lungs. This is one of the easiest ways to empower parents to take control over their children's health without having to invest significant resources in new infrastructure or traffic reduction efforts.

Portland, Oregon: Sharing the Road

The city of Portland, Oregon is renowned for its commitment to bicycling. In February 2010, the Portland City Council adopted the Portland Bicycle Plan for 2030, which sets a goal that 25 percent of all trips will be made by bicycle by the year 2030. As part of the comprehensive plan, Portland seeks to increase its network of bicycle facilities.

One strategy that Portland has adopted is the "Neighborhood Greenways" concept. These are residential streets with low traffic speeds and volumes that are marked to give bicyclists and pedestrians priority. The "sharrow" street marking, which is painted onto the road, indicates that bicycles and cars should share the lane, reminds drivers that bicycles are allowed on the street and provides guidance to the bicyclist as to proper positioning within the lane. As part of the upgrade to a greenway, the streets are outfitted with speed bumps and traffic diverters, which tend to encourage drivers to avoid the streets unless necessary, shifting even more traffic to the main roads and off the greenways. Because the streets selected as neighborhood greenways are already low-volume roads and are enhanced with speed bumps and infrastructure that further reduces traffic, these greenways are an ideal low-pollution location for families and children to safely walk and bicycle.

In addition to the safety and air pollution benefits, the neighborhood greenways are relatively inexpensive to install, simply requiring paint for the street markings, the addition of speed bumps and improvements to crossings and curb ramps. As of March 2011, Portland had 46 miles of neighborhood greenways installed, with another 25 miles funded for installation and 78 more miles in the planning phase.



Washington State and Omaha, Nebraska: Mapping Low-Traffic Routes to School

The state of Washington's regulations require school districts to have suggested walking route plans for any elementary school where children walk to school. The plan must cover a one-mile distance from school with suggested routes. A more recent law, passed in 2009, which goes into effect in September 2012, requires school districts to establish walking areas for all school buildings.

To help school districts comply with the laws and regulations, the Washington State Department of Transportation produced a guide for school administrators called "School Walk and Bike Routes: A Guide for Planning and Improving Walk and Bike to School Options for Students." While the guide focuses on traffic safety and does not address air quality, the recommendations in the guide for how to develop walking route plans may easily be applied.

One of the three key purposes of the route plans, as identified by the guide, is to suggest routes with the greatest physical separation between cars and children walking and that expose children to the lowest speed and lowest volumes of traffic. These are the same factors that should be considered when selecting lower-pollution routes to school. The handbook provides specific step-by-step instructions for how to inventory walking conditions around the school and recommends contacting the public works department to identify streets with high volumes of traffic that should be avoided.

On a much simpler level, Activate Omaha, in Nebraska, is providing similar guidance to parents looking to increase walking to school through "walking school buses," in which a parent chaperone escorts a group of children on the walk to school. Activate Omaha is focused on designing the built environment so that more people can live active lifestyles. As part of this mission, Activate Omaha helps organize walking school buses and Safe Routes to School efforts at schools throughout the city. The Walking School Bus Guidelines for Organizers document provides easy-to-understand instructions for how

to plan and start a walking school bus. The checklist includes tips for avoiding busy, multi-lane roads and to select routes with sidewalks and infrastructure providing children with a safe place to walk. Again, while this publication is not specific to air pollution, these tips will also lead to the selection of walking routes with less exposure to traffic pollution.

Cambridge, United Kingdom: A Web-Based Solution

Walkit.com is a website that promotes walking in towns and cities throughout the United Kingdom. It includes a walking route planner to either get from point A to B or to plan a circular route to allow for an exercise walk. Users of the website can either select a direct route or a "less busy" route to favor slightly longer routes along quieter streets.

In partnership with the Cambridge City Council, walkit.com has also premiered a "low pollution" option when selecting walking routes in Cambridge. The city of Cambridge is required by law to reduce its traffic pollution levels in the central part of the city and has developed a multi-faceted plan. One part of the plan is to increase walking and bicycling for short trips within town and to do so in a way that does not increase an individual's exposure to traffic pollutants.

The city was already required to produce air quality modeling maps that measured nitrogen dioxide pollution levels throughout the city. Rather than have those maps sit unused, the Cambridge City Council overlaid the pollution measurements over a map of the roads and paths in Cambridge. Those maps have now been made available on walkit.com. When visitors to the website select the city of Cambridge and enter in a destination, they can also select the "low pollution" option. Behind the scenes, the trip generator examines the various routes for average exposure to nitrogen dioxide and the length to measure the exposure for the route. The algorithm selects a route that minimizes overall exposure to traffic pollution.

Links to Additional Resources

Portland, Oregon

Portland Bicycle Plan:
http://www.portlandonline.com/transportation/index.cfm?c=44597&

Portland Bureau of Transportation "Neighborhood Greenways":
http://www.portlandonline.com/transportation/index.cfm?c=50518

Portland Bureau of Transportation Bike Maps:
http://www.portlandonline.com/transportation/index.cfm?action=UpdateItem&category_id=748&c=40884

Washington State

School Walk and Bike Routes: A Guide for Planning and Improving Walk and Bike to School Options for Student:
http://www.wsdot.wa.gov/NR/rdonlyres/5463FD69-F7B9-477D-B9AA-D21CEEFCF722/0/SchoolAdminGuide.pdf

Omaha, Nebraska

Activate Omaha Walking School Bus Guide:
http://activateomaha.org/downloads/walkingschoolbuswebbooket.pdf

Cambridge, United Kingdom

WalkIt route mapping tool:
http://www.walkit.com

Cambridge City Council air quality plan:
http://www.cambridge.gov.uk/ccm/content/environment-and-recycling/pollution-noise-and-nuisance/air-pollution/air-pollution-in-cambridge.en

Shifting car trips to walking and bicycling through education and encouragement

Because the large majority of children arrive at school in cars or buses, the streets around the school and the school campus itself are often choked with traffic. Backups of vehicles approaching the school can result in long delays for the cars and buses to travel short distances, all the while producing traffic pollution.

Among children who live less than one mile from school in the United States, 43 percent are driven to school.[48] These short trips could be shifted to walking and bicycling, significantly reducing the number of polluting vehicles around the school. These short trips are also higher-polluting because the first few minutes of driving a vehicle, which is called a "cold start," results in higher emissions while the engine warms to its optimal temperature.

One technique for shifting trips from cars to walking and bicycling is through education and encouragement programs. Helping parents understand the impact of their choices on the health of their children and other students can prompt a change in behavior. In addition, schools can help encourage more walking and bicycling trips through special events, such as walking weeks, or by making it easier for parents to choose the walking trip, such as through walking school buses.

Within the Safe Routes to School movement in the United States and programs in other countries, there are numerous examples of how education and encouragement initiatives can increase walking and bicycling trips, thereby reducing vehicle traffic and traffic pollution.

ZOOM Kids on the Move, Europe: Footprints for a Greener World

The Climate Alliance is a European association of more than 1,600 cities, municipalities and districts in 18 European countries, all united in their goals to reduce greenhouse gas emissions and protect the climate. Among its numerous strategies is ZOOM Kids on the Move. Now in its tenth year, ZOOM is a coordinated Europe-wide campaign to encourage children to walk and bicycle to school to help save the planet. ZOOM helps children to learn about different methods of sustainable transportation and environment. Participating schools can download

materials from the ZOOM website and commit to hold a ZOOM activity week sometime between April and November. During the week, children are asked to walk and bicycle to and from school as much as possible. For each sustainable trip, children get to draw their own "green footprint" to represent their green way to school and receive a green sticker to put in their ZOOM sticker album.

Schools collect all the green footprints and then forward them to the Climate Alliance. Each year, the Climate Alliance presents the accumulated footprints to a representative from the United Nations Climate Change Conference to show what children can collectively accomplish. In 2011, more than 200,000 children across 25 countries (primarily European) collected 2.7 million green footprints; each one representing a walking or bicycling trip to or from school in just one week.

While this initiative focuses on the greenhouse gas and climate change aspects of walking and bicycling to and from school, it could easily be adapted to also focus on the air quality benefits of making sustainable transportation choices.

Eagan, Minnesota: Making the Healthy Choice the Easy Choice

Eagan, Minnesota is a suburb of Minneapolis-Saint Paul and its Red Pine Elementary serves 950 children from the town and several surrounding farming communities. Eagan has a network of sidewalks and crosswalks in the neighborhoods around school, providing safe infrastructure for walking and bicycling.

However, in spite of these safe facilities, many parents were in the habit of driving their children to school—resulting in significant traffic backups of more than 100 cars around the school. The backup often extended a quarter-mile from the school and onto a nearby highway. Red Pine Elementary principal, Gary Anger, realized that Safe Routes to School education and encouragement activities were necessary to shift some of these car trips to walking and bicycling.

With a small $10,000 Safe Routes to School non-infrastructure award, the school implemented a comprehensive encouragement and education strategy. The school first produced a Safe Routes to School map to identify sidewalks, crosswalks, school patrols and safer walking routes. Children in closer neighborhoods were invited to join walking school buses and drop-off zones were added at the beginning of the walking school bus routes to allow

children from farther away to join the walking school bus and reduce traffic at the school. The school implemented these provisions as part of their efforts on health and physical activity—including incentives to walk and run at recess, fitness fairs on the weekends and bicycle donations to low-income children.

With this comprehensive approach, Red Pine Elementary has more than doubled the number of children regularly walking and bicycling to school—from 75 to 200 children. And, the number of cars dropping children off at school has declined from 100 cars to just 40 to 45 cars—nearly eliminating traffic congestion and backups around the school, which reduces associated traffic pollution.

Travelwise NI, Northern Ireland: A National Walk to School Strategy

Travelwise NI is a government initiative in Northern Ireland that promotes sustainable transportation options as alternatives to the private car. It promotes activities such as walking, bicycling, car sharing and using public transportation to schools, shops and workplaces. Travelwise NI estimates that reducing the number of cars on the trip to school by 20 percent will reduce congestion and the potential for exposure to pollution at schools.

Specific to schools, Travelwise NI provides a range of materials and resources to teachers and schools and conducts nationwide walk to school campaigns each year. Among the resources provided is the "Best Foot Forward" teaching tool, which is a curriculum unit that teachers can use to help students learn about the impact of transportation choices, and resource guides for creating walking school buses.

Each year, Travelwise NI holds two annual awareness-raising events: Walk to School Week and Walk to School Month. It also has a year-round initiative to promote walking to school, called Walk Once a Week (WOW). These programs encourage children, parents and teachers to participate in walking and bicycling to school and related activities. In 2012, the Walk to School Week took place from May 21st to 25th, with the theme of take a "Step Forward in Time." This theme aims to enhance children's understanding of the importance of preserving the planet for future generations. It encourages children to consider the significant contribution they can make by choosing a more sustainable travel option. In advance of the Walk to School Week, Travelwise NI held a poster contest for children to design a poster that was used during the Walk to School Week. The school with the winning poster designer received a prize voucher worth 750 pounds for an outdoor adventure center or a sports retailer.

Links to Additional Resources

ZOOM Kids

Climate Alliance:
http://www.klimabuendnis.org/585.html

ZOOM Kids on the Move:
http://www.zoom-kidsforclimate.eu/

Zoom Kids on the Move 2011 Results:
http://www.zoom-kidsforclimate.eu/fileadmin/inhalte/Dokumente/englisch/2011/Zoom_%E2%80%93_Kids_on_the_Move_Report_2011.pdf

Eagan, Minnesota

Red Pine Elementary Safe Routes to School initiative:
http://www.district196.org/rp/SafeRoutesToSchool.html

Northern Ireland

Travelwise NI for Schools:
http://www.nidirect.gov.uk/index/information-and-services/travel-transport-and-roads/travelwiseni/travelwise-schools.htm

Travelwise NI Curriculum and Materials for Schools:
http://www.nidirect.gov.uk/index/information-and-services/travel-transport-and-roads/travelwiseni/travelwise-schools/travelwise-teachers/free-schools-resources.htm

Reducing traffic volumes through infrastructure

Lack of traffic safety is one of the primary barriers to getting more children walking and bicycling to school. When surveyed about walking to school, parents in the United States cite lack of safety, as well as the distance to school, as their top two barriers.[49] Parents specifically express concerns about traffic speeds, traffic volumes, lack of sidewalks and missing crosswalks as key hazards.[50]

To change habits and shift more school trips out of cars to walking and bicycling, it is critical to make infrastructure improvements so that parents can be more assured of their children's safety. There are many infrastructure improvements that have been proven to reduce pedestrian and bicycle deaths and injuries. For example, pedestrians are more than twice as likely to be struck by a car when walking in a location without sidewalks as they are when walking in an area with sidewalks.[51] Adding speed humps decreases the risk that a pedestrian will be struck by 53 percent.[52] Installing refuge islands in crosswalks, which are protected medians that allow pedestrians to safely wait in the middle of the street for a break in traffic before continuing to cross, can reduce the likelihood of pedestrian-vehicle crashes by 66 percent.[53] Simply increasing street lighting to improve visibility can reduce pedestrian-vehicle crashes by 59 percent.[54]

Adding these types of infrastructure improvements have been shown to increase walking and bicycling, which also reduces the number of polluting vehicle trips. A study of Safe Routes to School infrastructure improvements in California found that children traveling through pedestrian-friendly environments are more likely to walk or bicycle to and from school.[55] Another study found that a five percent increase in neighborhood walkability (a measurement that looks at the completeness of the sidewalk network, safety of street crossings, directness of routes and other measures) resulted in 32.1 percent more minutes devoted to physically active travel and a six percent reduction in vehicle miles traveled.[56]

An integral component of the federal Safe Routes to School program is building infrastructure improvement. In this program, 70 percent to 90 percent of available funds are dedicated to sidewalks, crosswalks, traffic calming and other infrastructure improvements for bicyclists

and pedestrians. Thousands of schools around the country in all 50 states are already benefiting from Safe Routes to School funding to make routes to school safer. These safety improvements also can increase walking and bicycling and reduce the number of car trips to school, which has the added benefit of positively impacting air quality.

Eugene, Oregon: Making an Older School Safe for Walking and Bicycling

Roosevelt Middle School in Eugene, Oregon is located at a busy intersection with high traffic volumes. Since the school was built in 1942, it has a very small drop-off zone, resulting in traffic congestion around the school from parent vehicles. These factors combined with inadequate sidewalks and crosswalks presented safety hazards for children. Parents approached the school district safety manager and city staff to express their concerns and to ask for the school and city to apply for Safe Routes to School funding. From 2007 to 2010, Roosevelt Middle School received several Safe Routes to School awards totaling $600,000 to allow the middle school to address safety concerns.

Using these funds, improvements were made at Roosevelt Middle School and five other schools throughout Eugene. Infrastructure improvements included new walking paths, crosswalks upgrades with pedestrian refuges and school zone signage. Through these improvements, walking and bicycling rates at Roosevelt Middle School have grown from 27 percent to 42 percent of all students. The growth in walking and bicycling has resulted in 53 fewer cars picking up or dropping off children each day, a 24 percent reduction in traffic volume. Less idling and stop-and-go conditions that can result in high concentrations of traffic pollutants are beneficial for the reduction of traffic emission and exposures. In addition, Roosevelt Middle School designated two parking lots near (but not at) the school as preferred parking areas to divert parent vehicles away from the immediate school environment.

Links to Schools, United Kingdom: Prioritizing Traffic-Free Infrastructure for Children

Sustrans is a charity in the United Kingdom that is focused on sustainable transportation. In 1995, Sustrans started the National Cycling Network with a grant from the United Kingdom's national lottery. Sustrans also runs the United Kingdom's Safe Routes to School program. As of May 2012, the National Cycling Network featured 13,400 miles of walking and cycling routes, including traffic-free paths, low-traffic roads and lanes and on-road routes

signed for bicyclists. Approximately 57 percent of the population in the United Kingdom is within one mile or less of the network. As a whole, more than one million walking and bicycling journeys take place every day on the network.

In 2004, the United Kingdom's Department of Transport provided £10 million (GBP) in funding to Sustrans to link the National Cycling Network to schools. As a result, Sustrans has connected more than 1,000 schools in 500 locations to the National Cycling Network through the installation of new bike paths, pedestrian crossings and traffic calming. Priority is given to improvements that create traffic-free paths for children that are separated from roads, although some projects include extensive traffic calming and on-road bicycle lanes when a traffic-free alternative is not possible. Part of the rationale for the Department of Transport's investment in Links to Schools is to create safe routes to schools that are protected from traffic, both to improve safety for children as well as to reduce their exposure to traffic pollution. The safer, traffic-free routes have given more parents the confidence to allow their children to travel to school by foot and bike.

In the first 18 months of the project, Links to Schools connected 300 schools to the network, benefitting 200,000 students. Sustrans conducted extensive surveys and case studies to determine the impact of the project. Across the 19 Links to Schools locations studied, as of 2005, three million trips per year were being taken on the Links to Schools networks, with one million of those trips replacing car trips. Many of the case studies have specific data on the destination of network users. For example, in Warwickshire, a new walking and bicycling bridge connected parkland paths to several primary and secondary schools, with nearly the entire length on traffic-free paths. Since the installation of this infrastructure, 140,000 trips per year are taken on these paths, with 75,000 of those trips by children. Children's trips to school represent 49,500 of those trips per year. A school official in Warwickshire indicated that all six schools reached by the Links to School have seen noticeable increases in walking and bicycling to school and reductions in traffic problems nearby.

By creating safe routes to schools, the Links to Schools project allows more children to walk and cycle, which reduces traffic levels and the number of cars outside of schools. With less cars and decreased congestion, air quality has improved and exposures to traffic pollutants have been reduced. Through improved access to additional routes for children to walk and bicycle to school, Links to Schools has allowed much wider community access to schools, workplaces, shops and green spaces, further compounding the air quality benefits.

Links to Additional Resources

Eugene, Oregon

Eugene Safe Routes to School program:
http://eugenesrts.org/

Eugene infrastructure improvements:
http://eugenesrts.org/news/buildingsaferroutes

United Kingdom

Sustrans National Cycle Network:
http://www.sustrans.org.uk/what-we-do/national-cycle-network

Sustrans Safe Routes to School program:
http://www.sustrans.org.uk/what-we-do/safe-routes-to-schools

Sustrans Links to Schools program:
http://www.sustrans.org.uk/what-we-do/links-to-schools

Links to Schools case studies:
http://www.sustrans.org.uk/assets/files/rmu/Links%20to%20Schools%20Publication.pdf

Limiting idling on school grounds

Due to the sheer number of buses and vehicles involved in a school's arrival and dismissal times each day, idling vehicles can present a challenge for schools. Parents may sit in their cars with the engines running while waiting for their children to come out of the school. Some schools have even created detailed pick-up procedures in which parents wait their turn to collect their children in their cars, again with engines running, which has a negative impact on air quality. Schools buses also may idle their engines while waiting to pick up or drop off children.

As a result, the amount of traffic pollution at arrival and dismissal can be significantly higher than other times of the day. And, as car and bus idling generally occurs near the front entrance of schools, all children, whether they are walking, bicycling, riding the bus or being driven by their parents, may be exposed to traffic pollution. As noted earlier in this resource guide, exposure to high concentrations of traffic pollution may adversely affect children's health, particularly children with asthma, allergies and other respiratory conditions.

No-idling campaigns have sprung up in a number of locations around the country to encourage or even require drivers to turn off their engines while waiting at school. Some no-idling campaigns focus on school buses and trucks that produce higher levels of some types of pollution. Other campaigns try to instill the habits of no idling into parent drivers as well. While, these campaigns are often run separately from Safe Routes to School initiatives, Safe Routes to School practitioners could adopt no-idling campaigns as part of their initiatives to help ensure that all children attending the school have less exposure to traffic pollution. Further, idling for more than 15 to 30 seconds uses more fuel than turning off the engine and restarting it. Therefore, implementing no-idling zones could potentially save parents and school districts money on fuel.

Arizona Department of Environmental Quality: Implementing Strategies to Prevent School Bus Idling

The Arizona Department of Environmental Quality (ADEQ)'s Office of Children's Environmental Health operates a number of programs to address air quality issues specific to children's health. In 2004, ADEQ began a School Bus Idling Reduction Program. The program initially launched as a pilot program in seven school districts, but has since expanded to dozens of school districts throughout the state. The objective of the program was to reduce children's exposures to diesel emissions from buses that are idling at the schools.

The Arizona Department of Environmental Quality worked with several school districts to draft a school bus idling policy, which school boards could adopt. The sample policy requires school bus drivers to turn off the engine once they reach the school and can only turn the engine back on when leaving, unless specific exemptions due to weather or safety conditions apply. School buses also are required to park at least 100 feet from any known or active air intake for the school. The sample policy further recommends that school districts integrate idling limitation requirements in contracts with vendors that will be operating vehicles on school campuses and that they post no idling signage throughout the campus, targeted to school bus drivers, vendors and parents.

At the national level, the U.S. Environmental Protection Agency (EPA) has a national School Bus Idle Reduction Campaign. The EPA website includes a number of materials that can be helpful in implementing a school bus no idling campaign, including a calculator to determine the fuel savings for reducing idling in the school bus fleet, a sample no idling policy and no idling pledge cards for school bus drivers.

Clean Air Campaign, Georgia: Getting Parents to Turn Off Their Engines

The Clean Air Campaign is a Georgia-based nonprofit that works in contract with the Georgia Department of Transportation (GDOT) to promote common-sense solutions that reduce vehicle miles and traffic pollution. In 2004, the Clean Air Campaign launched a new initiative, called the Clean Air Schools program. More than 300 schools in 35 school districts participate in the Clean Air Schools program to create safer and healthier schools through minimizing traffic pollution.

The Clean Air Schools program provides a suite of activities to help children to learn about air-quality and to help schools reduce traffic. A primary part of the Clean Air Schools campaign is its No Idling program. Funded by the UPS Foundation and Kaiser Permanente, the No Idling program focuses on reducing car and bus idling at schools. Participating schools receive metal no-idling signage for school grounds and educational materials for bus drivers, parents and students, all free of charge. Parents or school personnel can also download a checklist, surveys to measure success and sample newsletter announcements about the No Idling campaign.

Two other activities included in the Clean Air Schools program are the Pool to School program, which encourages parents to organize carpools with other families to reduce car trips to school and the Ride the Bus! For Clean Air program to encourage more children to ride the school bus rather than their parents' vehicles. The Clean Air Schools program also provides sample lesson plans that teachers can use to instruct their students about the linkages between transportation and air quality.

In October 2011, the Clean Air Campaign launched an inaugural Clean Commute Week to help schools start their clean air campaigns. One participating school, High Meadows School in Roswell, Georgia, focused its Clean Commute Week on no idling. Students wrote articles and made signs to help persuade drivers to stop idling. They practiced delivering their no idling message in a friendly way and marched through the campus throughout the week to urge drivers to turn off their engines.

The Clean Air Campaign's efforts have been so successful that the Earth Day Network, a national nonprofit, has taken notice. The Earth Day Network has now launched a nationwide No Idling Campaign, built off of the Clean Air Campaign's work. Available on the Earth Day Network website are sample school district policies and toolkits for parents and teachers that include downloadable no idling materials and lesson plans.

Links to Additional Resources

Arizona Department of Environmental Quality (ADEQ)

ADEQ sample school bus idling policy:
http://www.azdeq.gov/ceh/download/bus_idle.pdf

ADEQ video about school bus idling:
http://www.azdeq.gov/ceh/busvid.html

ADEQ anti-idling toolkit:
http://www.azdeq.gov/ceh/toolkit.html

Additional school bus idling resources

Environmental Protection Agency (EPA) National School Bus Idle Reduction Campaign:
http://www.epa.gov/cleanschoolbus/antiidling.htm

EPA fuel savings calculator from reduced school bus idling:
http://www.epa.gov/cleanschoolbus/idle_fuel_calc.htm

Compilation of anti-idling regulations throughout the nation (by the California Air Resources Board):
http://www.arb.ca.gov/regact/sbidling/appb.pdf

The Clean Air Campaign

Clean Air Schools:
http://www.cleanaircampaign.org/Your-Schools

Overview of Clean Air Schools programs:
http://www.cleanaircampaign.org/Your-Schools/Learn-About-Clean-Air-Schools/Programs-Overview

Clean Air Schools lesson plans:
http://www.cleanaircampaign.org/Your-Schools/Find-Air-Quality-Lesson-Plans-and-Resources

Additional parent idling campaign resources

Earth Day Network no idling toolkit:
http://www.earthday.org/noidling

Anti-idling primer (by the Hinkle Charitable Foundation):
http://www.thehcf.org/antiidlingprimer.html

Reducing diesel exhaust around schools

Diesel exhaust, emitted by school buses, trucks, construction equipment and other heavy vehicles, is a particularly dangerous type of traffic pollution. Older diesel engines emit dozens of hazardous air pollutants, particles and gases. In addition, a component of diesel exhaust is black carbon, which is a form of particulate matter and a major contributor to climate change. While new diesel engines are required to be equipped with emission-reduction technologies or use ultra-low sulfur diesel, there are older diesel engines currently in use that continue to emit high levels of pollution.

School buses, which primarily use diesel fuel, are designed to be used for many years. As school buses deliver children to school and possibly also sit idling on school grounds, children are exposed to diesel exhaust. A groundbreaking study released in 2002 found that concentrations of fine particulate matter were 5 to 10 times higher inside diesel school buses than outside the buses. Levels of fine particulate matter and black carbon were higher when buses were idling with doors or windows open, when buses were traveling in heavy traffic and particularly when buses were idling while loading and unloading students.[57]

Older school buses can be retrofitted with modern emission-reduction technologies that help trap particulate matter or filter out some of the most harmful emissions. School buses also can be modified to use alternative fuels such as ultra-low sulfur diesel that burns cleaner. Installing a comprehensive suite of emission-reduction technologies and converting to ultra-low sulfur diesel can reduce the emissions of fine particulate matter by 90 percent and of carbon monoxide by 50 percent. Many states have funding available to support retrofitting school buses to reduce emissions.

Children also can come into contact with diesel emissions if the school is located near a port, industrial area or transportation depot, with higher levels of trucks and heavy vehicles driving near the school. Given the health risks posed by diesel exhaust, school districts and parents should consider examining not only the volume of traffic around and at schools, but what types of vehicles make up that traffic. There are a few examples of schools and communities working together to request changes in trucking routes to avoid sensitive areas like schools and residential areas. This can be a difficult undertaking, but some communities have been successful.

Clean Air School Bus Program, New York: Funding School Bus Retrofits

The New York State Energy Research and Development Authority (NYSERDA) is a state government agency charged with helping New York reduce energy consumption, increase the use of renewable energy sources and protect the environment. One of its many initiatives is the Clean Air Bus Program, which provides funding to school districts and communities to help them retrofit school buses with advanced emission-reducing equipment or to purchase clean-fueled buses. The Clean Air School Bus Program seeks to maximize the environmental, economic and energy benefits through reducing emissions in New York State school buses.

Grants cover the entire cost of retrofitting a school bus and up to $100,000 per school district is available. Thus far, NYSERDA has awarded $7.5 million in two rounds of grants to retrofit approximately 3,500 school buses across the state. While this is an impressive number, it is only approximately eight percent of the state's school bus fleet. NYSERDA estimates that the retrofits have resulted in annual emission reductions of 150,000 pounds of hydrocarbons, 12,000 pounds of particulate matter and four million pounds of carbon monoxide. A third round of funding is open for applications in 2012, with another $2.6 million available exclusively for retrofits.

The results of these retrofits are clearly documented at the local level as well. Webster Central School District in upstate New York was an early recipient of Clean Air School Bus Program funding, which allowed the district to retrofit 74 buses with emissions-control technology. Over the lifetime of each bus, NYSERDA estimates a savings of 1,400 pounds of particulate matter, 326,000 pounds of carbon monoxide and 13,300 pounds of hydrocarbons. Long Beach City School District received a $1.2 million grant to purchase 20 new school buses fueled by compressed natural gas (CNG), to retrofit 18 existing buses with CNG and to create a CNG fueling station. The Webster Central School District has the distinction of being the first school district in the state to operate an entire fleet of clean-fueled school buses. The new CNG buses and retrofitting of current school buses over the lifetime of the vehicles will result in emission reductions of 4.8 million pounds of pollutants, along with 505,000 gallons of petroleum.

Across the nation, many states provide funding for school bus retrofits, which are generally provided through the state's environmental protection agency. In addition, the U.S. Environmental Protection Agency (EPA) also provides annual funding to each state for a variety of clean diesel projects and retrofits. States can use their funding for a wide range of clean diesel projects, including school bus retrofits. In addition,

the EPA regularly holds a national grant competition in its National Clean Diesel Funding Assistance Program to support diesel retrofits on a wide range of vehicles, including school buses. School districts and municipalities are among the eligible entities and competed for approximately $20 million in FY 2012.

North Richmond, California: Routing Diesel Trucks Away from Schools and Residential Areas

North Richmond, California is a small community located in the city of Richmond within the San Francisco Bay area. Because the city includes a number of industrial facilities, including a Chevron refinery, high numbers of trucks travel through the community to get to the nearby Richmond Parkway, a major transportation corridor. These trucks often used local streets, causing traffic pollution, noise and pedestrian safety problems for students at Verde Elementary School and nearby residential neighborhoods.

To address these concerns, the Contra Costa County Redevelopment Agency secured a planning grant from the California Department of Transportation to allow it to conduct a truck route study in North Richmond. The final Truck Route Study focused on identifying a way to channel trucks to major transportation corridors while minimizing the impact on Verde Elementary School and residents. The County Redevelopment Agency conducted a preliminary assessment of potential routes and partnered with four local community-based organizations to get input from local residents and businesses.

The study ultimately recommended a route that skirted existing residential areas and Verde Elementary School and connected trucks with existing designated truck routes. Reducing and rerouting the truck traffic away from neighborhood streets and in close proximity to the school will reduce exposures to several traffic pollutants at the school and when walking and bicycling to and from school.

The recommended route is broken into two phases. The first phase, meant to redirect trucks without waiting years for construction, included adding signage to notify truck drivers of trucking restrictions, speed bumps and greater levels of police enforcement at a cost of approximately $100,000. The second phase involves the construction of a new street segment along the railway to connect trucks directly with Richmond Parkway and avoiding the community altogether. This project is estimated to cost approximately $22 million and is awaiting the identification of a funding source before it can move forward.

Links to Additional Resources

Diesel Health Impacts

Diesel Health in America report (produced by The Clean Air Task Force): **http://www.catf.us/resources/publications/files/Diesel_Health_in_America.pdf**

Map of Diesel Soot Health Impacts: **http://www.catf.us/diesel/dieselhealth/**

Children's Exposure to Diesel Exhaust on School Buses report (produced by Environment & Human Health, Inc.): **http://www.ehhi.org/reports/diesel/**

New York State Energy Research and Development Agency (NYSERDA)

Overview of the NYSERDA Clean Air School Bus program: **http://www.nyserda.ny.gov/en/Page-Sections/Research-and-Development/Alternative-Fuel-Vehicles/Clean-Air-School-Bus-Program.aspx?sc_database=web**

2012 application for NYSERDA Clean Air School Bus program: **http://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-1896-New-York-State-Clean-Air-School-Bus-Program.aspx**

U.S. Environmental Protection Agency (EPA) Diesel Retrofit funding

EPA's Clean Diesel Grants to States: **http://www.epa.gov/cleandiesel/projects/proj-state.htm**

EPA's National Clean Diesel Funding Assistance Program grants: **http://www.epa.gov/diesel/prgnational.htm**

North Richmond, California

Contra Costa County overview of the North Richmond Truck Route study project: **http://www.ccreach.org/ccc_redevelopment/nr_majorProjects_truckroute.cfm**

North Richmond Truck Route Study executive summary: **http://www.ccreach.org/ccc_redevelopment/NR_documents/NR%20Truck%20Route%20Exec%20Summary.pdf**

North Richmond Traffic and Circulation memorandum: **http://northrichmondplan.info/images/Traffic%20and%20circulation.pdf**

Siting schools in low-pollution and accessible locations

A national study examined the locations of schools in major urban areas in relation to highways and then extrapolated the findings nationwide. The study estimates that approximately one out of every three schools in the United States are in "air pollution danger zones," which means they are located within a quarter-mile of a major highway.[58] As school districts build new schools, the location and its proximity to major roadways to avoid high pollution levels is an important consideration.

Maximizing the distance between school sites and higher-volume roadways will greatly reduce the level of exposures that children may have to traffic pollutants. Prevailing wind direction, however, can have a large impact on how much traffic pollution to which children may be exposed. For example, traffic pollution will have less of an impact on a school that is closer to the roadway, but upwind of the traffic (wind is blowing over the school and toward the roadway) than a school that is further from the roadway and downwind of the traffic (wind blows pollutants from roadway toward school).

The location of the school relative to the students it serves is another important consideration. Larger schools on the outskirts of communities make it difficult for families to walk and bicycle to and from school and require the use of higher volumes of buses and personal vehicles to transport children. As a result, these schools might have higher levels of traffic pollution in the vicinity of the school. The U.S. Environmental Protection Agency found that schools located near or within the neighborhoods of its student population reduce traffic, produce a 13 percent increase in walking and bicycling and reduce vehicle miles and traffic pollution emissions by at least 15 percent.[59]

California: Siting Schools Away from Highways

Two California studies focusing on schools and traffic pollution completed in 2003 clearly demonstrated the dangers of locating schools near highways. One study took pollution measurements at 10 schools in Alameda County (San Francisco Bay area) and surveyed children about their health. The results showed that children at schools located closer to highways had higher levels of respiratory health problems.[60] Another study mapped California schools and their proximity to high-traffic roads. The results found that 9.5 percent of schools were located within 450 feet of roads carrying at least 25,000 vehicles per day.[61]

Preliminary findings from these studies prompted the California legislature to pass S.B. 352 in 2003. The law prohibits new schools from being sited within 500 feet of a highway or busy roadway, unless air pollution modeling can show that the air quality at the proposed site does not present a short-term or long-term health risk to students.

In April 2005, the California Air Resources Board issued an Air Quality and Land Use Handbook to help school boards and communities understand and evaluate the health impacts of air pollution from a wide range of sources. Sections of the handbook give specific recommendations for locating facilities that serve sensitive populations, such as day care centers, away from highways. The handbook also discusses the regulations that specifically apply to schools.

Guidance from the California state government has worked its way down to the local agencies that must implement the laws and regulations. For example, the South Coast Air Quality Management District, which is the air pollution control agency for Orange County, Los Angeles County and several other nearby counties, has issued an extensive guidance document to help school districts understand the numerous school siting requirements and recommendations. The guidance document helps ensure that school districts select school sites that minimize as much as possible children's exposure to traffic pollution.

While a few other states, such as Georgia or North Carolina, recommend or suggest that school districts seek sites for schools that are away from high-traffic locations, California is the state with the most advanced restrictions.

Providence, Rhode Island: Saving a Historic Neighborhood School

In 2006, Nathan Bishop Middle School on the East Side of Providence, Rhode Island was targeted for closure due to shrinking enrollments and low student achievement. The school board intended to demolish the structure and build a new high school elsewhere in Providence. Other school sites would likely have increased the distance from the school to residences, resulting in greater levels of driving.

Originally built in 1921, the school was a historic building and a long-standing center of the community. Parents and residents launched a campaign to save the school and inundated the school board with pleas to reconsider the decision. After hearing input from hundreds of residents, then-Superintendent Donnie Evans announced that Nathan Bishop Middle School would be renovated into a state-of-the-art school and use green techniques to make the school environmentally sustainable and save money on annual utility costs. The environmentally friendly renovation design

received the 2009 "Rhody Award for Historic Preservation" from the Rhode Island Historical Preservation and Heritage Commission. The renovation project cost $33 million, which was $11 million less than estimates to build a new school at another location.

The school re-opened for the 2009-2010 school year to great acclaim from residents. Many parents have moved students from private schools back into the public school system. Because nearly 80 percent of the school's students come from the nearby neighborhoods, distances are short enough for students to walk and bicycle to school. The school has located bicycle racks at the building's main entrances and walkways and bicycle lanes connect the school to the nearby residential areas.

Links to Additional Resources

California

Legislative text of S.B. 352: **http://info.sen.ca.gov/pub/03-04/bill/sen/sb_0351-0400/sb_352_bill_20031003_chaptered.html**

California Department of Education's implementation memo on S.B. 352: **http://www.cashnet.org/resource-center/resourcefiles/344.pdf**

California Air Resources Board Air Quality and Land Use Handbook: **http://www.arb.ca.gov/ch/handbook.pdf**

California fact sheet for schools about traffic pollution: **http://www.oehha.ca.gov/public_info/facts/pdf/Factsheetschools.pdf**

California fact sheet for parents about traffic pollution: **http://www.oehha.ca.gov/public_info/facts/pdf/Factsheetparent.pdf**

South Coast Air Quality Management District guidance document on air quality issues in school site selection: **http://www.aqmd.gov/prdas/aqguide/doc/School_Guidance.pdf**

Providence, Rhode Island

Nathan Bishop Middle School's green building features: **http://neep.org/uploads/policy/HPSE/Nathan%20Bishop%20RIDE%20Handout.pdf**

Other school siting resources

National Policy & Legal Analysis Network to Prevent Childhood Obesity (NPLAN) sample school siting policies: **http://www.nplanonline.org/nplan/healthy-school-siting**

National Trust for Historic Preservation's school siting resources: **http://www.preservationnation.org/information-center/saving-a-place/historic-schools/**

U.S. Environmental Protection Agency's Voluntary School Siting Guidelines: **http://www.epa.gov/schools/siting/**

Planning for Schools and Livable Communities: The Oregon School Siting Handbook: **http://www.oregon.gov/LCD/TGM/docs/schoolsitinghandbook.pdf?ga=t**

Conclusion

A large body of research clearly links exposure to traffic pollution with significant health risks, particularly for children. Those effects are even more acute in children with health problems like asthma. Because Safe Routes to School practitioners are seeking to encourage more children to walk and bicycle to increase physical activity and safety, it is important to also be aware of the risks of exercising in high-pollution areas and to take steps to reduce those risks.

As this guide describes, there are many solutions to reduce children's exposure to traffic pollution—and most of these solutions provide co-benefits with the goals of Safe Routes to School initiatives. There is a true synergy between efforts to reduce exposure to traffic emissions and Safe Routes to School, because many of the pollution reduction techniques also have additional health and safety benefits.

Incorporating air pollution reduction goals into Safe Routes to School initiatives will improve students' health and could help attract new partners or potential funders focused on the environment and air quality protection. Attention to improved air quality also adds to the benefits of Safe Routes to School, which can attract more families and children who are motivated by health to walk and bicycle to school and to become active in creating sustainable changes that improve the built environment and benefit air quality.

The Safe Routes to School National Partnership hopes this guide inspires practitioners around the country to pursue actions that reduce traffic pollution while also encouraging and enabling more children to safely walk and bicycle in cleaner air. We believe that so doing will help breathe new life into Safe Routes to School initiatives, which have already proven to increase physical activity and improve safety. Through the added lens of attention to air quality, Safe Routes to School practitioners will know that they are doing all they can to ensure that children are safe and healthy on the trip to school.

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