North Carolina Child Advocacy Institute
League of Women Voters of Wake County

March, 2004 Issue Brief

Fuming Over School Bus Diesel

The Take Home Points

- School buses are an integral component of North Carolina's public education system. Each day, over 13,000 school buses transport more than 700,000 students nearly a million miles.
- Virtually all school buses have diesel engines, and with good reason. They typically last longer, generate more horsepower, haul heavier loads, and operate more efficiently and safely than gasoline engines.
- Unfortunately, diesel efficiencies come at a cost: higher rates of particulate emissions. Studies continue to confirm that these emissions present a hazard to humans (higher rates of bladder cancer and cardiopulmonary diseases), and particularly children whose lung capacities are not fully-developed. These emissions are known to exacerbate asthma, which is already one of the leading causes of school absences.
- There are many ways in which these risks can be reduced. The following remedies can be implemented without cost:
  - Prohibit bus idling (with exceptions for safety);
  - Eliminate nose-to-tail queuing, as well as parking very near school ventilation intakes and play areas;
  - Assign the cleanest running buses to the most appropriate routes to minimize emissions.

  Other remedies would incur costs:
  - Require the use of biodiesel fuel;
  - If feasible, retrofit buses with catalytic converters and particulate traps.

Recommendations

- The State Board of Education should adopt policies and regulations immediately requiring the no-cost remedies statewide.
- The General Assembly should appropriate funds so that biodiesel fuel can be used by all school districts starting with the 2004-2005 school year.
- The State Board of Education should request that a study be done of the cost-benefit of retrofitting buses with catalytic converters (immediately) and particulate traps (later).

Introduction

The yellow school bus is a familiar sight in North Carolina's communities. Indeed, the school bus has become an integral component of the public education system. Each school day in our state, more than 13,000 buses transport more than 700,000 students nearly a million miles. The safety of the buses is therefore of great importance to parents and school administrators.

This Issue Brief is not in itself a scientific study. Rather, it is a compilation of the results of several studies and reports on a growing concern: diesel emissions and their effects on our students. Nor is this concern unfamiliar to the transportation staff in the state Department of Education and in the local school systems, who are dedicated to enhancing safety in the face of constrained resources. The purpose of this Issue Brief, then, is to create a heightened awareness of the problem of diesel emissions among state and local school boards, legislators, and parents, in the hope that a consensus on remedies can be developed and implemented as quickly and efficiently as possible.

Transportation: A Shared State-Local Responsibility

When additional buses are needed, school districts are responsible for their purchase. The state then assumes responsibility for replacing them based on mileage and age. School districts are responsible for maintenance, and follow a rigorous preventive maintenance program (including inspections every 30 days) required by the state. Overall, more than 90% of the cost of transportation operations (driver salaries, fuel, tires, repair parts, etc.) is covered by legislative appropriations that are allotted to the school districts using a formula that is based in part on efficiency of operation. The remainder is covered by local funding.

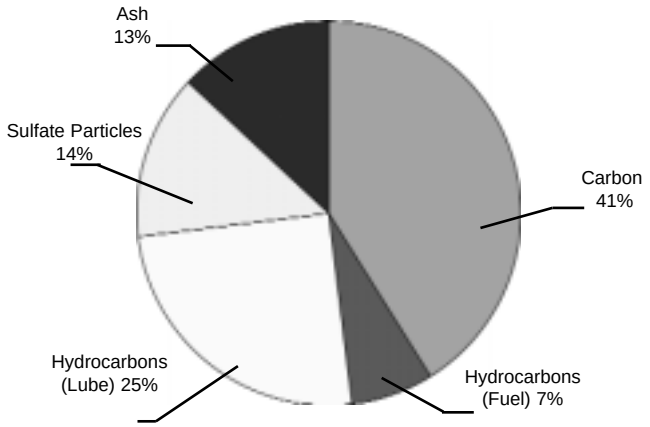
Diesels: The Upside

Virtually all school buses in North Carolina are powered by diesel engines, and with good reason. Compared to gasoline engines, diesels typically operate more efficiently over a wide range of conditions, particularly at lower speeds. Diesel engines operate at higher pressures, generate more horsepower, and can haul heavier loads than those powered by gasoline. Diesel fuel is somewhat less expensive than gasoline. Perhaps most importantly, diesel engines typically last much longer than gas engines. These impressive efficiencies have made diesels the traditional and current engines of choice.

Diesels: The Downside

Diesel's enhanced efficiencies come at the cost of toxic soot and smog-forming pollutants. The fuel and air mixture in diesel combustion chambers does not ignite simultaneously, and pockets of excess fuel cause soot to form. Soot formation is enhanced by the presence of sulfur in diesel fuel and certain additives in lubricating oil.

Figure 1: Composition of Diesel Particulate Matter



School buses release soot, technically known as particulate matter, directly from their tailpipes. Nitrogen oxides and hydrocarbons released from the tailpipe can also react in the atmosphere to create secondary particulates. Diesel particulate pollution is a complex mix of carbon, sulfate, ash and hydrocarbons. Figure 1 presents an example of a mix of particulate pollutants emitted from a standard heavy-duty diesel engine built after 1994.In all, diesel exhaust contains 40 chemicals that are classified as "hazardous air pollutants" under the Clean Air Act.

The Problem With The Downside

On a broader scale, diesel exhaust emissions contribute to overall concerns regarding air quality and global warming.(Heavier exposure to particulate matter of all types is correlated with higher death rates.) In addition, these emissions are classified as probable human carcinogens by many governmental authorities, including the US National Toxicology Program and the Environmental Protection Agency. A number of studies have found an association between diesel exhaust exposure and an increased risk for bladder cancer. Though somewhat frightening, these increased risks are associated with "background" levels of air pollution; thus, entire communities face these risks, not just students riding buses.

The specific concern, however, is that studies indicate that children in and around school buses are exposed to airborne particulate concentrations that are sometimes 5-15 times higher than background levels. More worrisome, more than 90% of diesel particulates have diameters less than 2.5 micrometers. These small particles are able to penetrate children's narrower pathways reaching deeper into the lung, where they are more likely to be retained. Higher rates of respiration among children may lead to their higher exposure, when measured per unit of body weight.

It is not surprising to find that children's exposure to these particulates is associated with exacerbation of symptoms of asthma, bronchitis and pneumonia. Heavier exposures are associated with decreased lung function, retarded lung development, and cardiopulmonary diseases. Asthma, in particular, is already an enormous problem in our students. It is one of the leading causes of school absences. (A study sponsored by the state Department of Health and Human Services in 2000 found that 28% of students in grades seven and eight had diagnosed asthma or asthma-like symptoms.) Thus, it is particularly critical that our students, already burdened by respiratory distresses, not be subjected to exposures that would further compromise their health.

Recommendations for Remedies

Fortunately, there are alternatives available that would allow school districts to provide transportation that is both safer and cleaner for our students (and our communities). Some of these remedies could be implemented at no or little cost, while others would require fiscal investments. Below are recommendations for consideration, presented in the ascending order of their cost.

- **School Bus Idling**. Idling should be restricted by state regulation. Research indicates that emission levels grow within buses when they stand in place idling. Bus drivers should be required to turn off bus engines immediately upon reaching their destinations. Buses should not be turned on until fully loaded. Exceptions can be made to accommodate conditions that would compromise passenger safety, such as extreme weather conditions. (Transportation experts can craft the list of exceptions.) Given that an hour of idling uses a gallon of fuel, this recommendation could actually save money.

- **Queuing and Parking**. Research indicates that, when buses are queued nose-to-tail, particulate and carbon levels rise substantially. If idling is prohibited, then this problem is mitigated. However, it would be safest to require school districts to eliminate nose-to-tail queuing when at all possible. (Perhaps schools could request exceptions to this requirement if they can show there are no reasonable alternatives.) Similarly, because particulate and carbon concentrations can migrate, a bus should not be parked near the school's ventilation intakes, nor next to school play areas.

- **Route Assignments**. Because of enhanced technologies and the lack of wear and tear due to use, newer buses generally run somewhat cleaner than older ones. Thus, route assignments should be made based on the objective of minimizing emissions. For example, rural areas may benefit from assigning newer vehicles to the longest routes; urban areas may benefit from assigning such vehicles to frequent stop-and-go routes. This probably occurs in many places already. However, it appears that a state policy (if not regulation) in this regard is appropriate.

- **Biodiesel Fuel**. Newer fuels can be used in current diesels without change to the engine, and would reduce particulate matter and hydrocarbons significantly. In fact, the Environmental Protection Agency will require the use of ultra-low sulfur diesel fuels as part of tougher clean air regulations that will be phased in during the period 2006-2010. Unfortunately, these fuels are not currently available in NC. However, due to the potentially harmful effects of the current fuel, it seems inappropriate to wait for federal requirements to take effect. A feasible immediate alternative is biodiesel, which is a mixture of refined vegetable oils and diesel fuel. Studies indicate that significant reductions in particulate matter and hydrocarbons are achieved with biodiesel. Happily, biodiesel is available in NC and could be produced here, offering an opportunity for economic development. State Department of Education transportation officials should develop a plan to make biodiesel available in all school districts by the beginning of the 2004-2005 school year. The General Assembly should provide appropriations that would cover the additional cost of biodiesel (estimated at 10%-20% above current fuel costs). If funding for statewide introduction of biodiesel is not available, priority should be given to EPA-designated air quality "non-attainment areas", which must demonstrate immediate improvements to avoid the loss of federal highway funds.

- **Particulate Traps & Catalytic Converters**. Though particulate traps can reduce soot emissions by 85%, they are neither effective nor recommended until ultra-low sulfur fuel becomes available. (They would clog up very quickly with the current fuel.) Catalytic converters, however, offer more immediate promise. Oxidation catalysts can reduce particulates by 20% to 50%. These converters are less expensive than traps (in the $1200 range), and can be retrofitted to many, though not all, of the current older buses. Until more accurate information regarding cost and feasibility becomes available, wholesale retrofitting is not recommended. However, state transportation officials should conduct a study of the cost-benefit of retrofitting (immedicately for converters and later for traps), and should encourage and facilitate retrofitting if feasible and opportunities arise.

- **Replacement Vehicles**. Part of the bus fleet statewide is replaced each year. Low emissions should be a major criterion in selecting replacement buses. State transportation officials should work with local officials to assure that this becomes a major part of the purchase process. In addition, state officials should work with appropriate federal agencies to secure all possible assistance (both technical and fiscal) to upgrade the bus fleets with the best possible low-emission vehicles. Alternative-fueled vehicles, including diesel-electric hybrids and natural gas, are becoming available and should be given strong consideration.

Concluding Statement

School buses are an essential component of the public education system, and will remain so for the foreseeable future. The hard work and dedication of all those involved in school transportation makes the school bus a safe way for students to attend school. It is now time to give these dedicated staff the support they need to make buses even safer by making them run cleaner. Several remedies could be implemented cost-free; others would require investments. All would offer greater protections for our students — protections they deserve, and protections we should be willing to provide.

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This publication is funded in part by the Citizen Education Foundation