



## Background on

# Diesel retrofits for school buses

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**A** study done by the Southern Alliance for Clean Energy showed that pollution levels can be up to five times higher inside a school bus than in outdoor air. Another study, cited by the American Academy of Pediatrics, found that a child riding inside a school bus may be exposed to as much as four times the level of diesel exhaust as someone riding in a car

School buses are important since they provide efficient, economic transportation, but more could be done to make them run cleaner. That's why the Minnesota Pollution Control Agency (MPCA) is collaborating on projects to cut bus tailpipe emissions and reduce bus idling.

### Focus on school buses

Minnesota's fleet of 13,000 school buses travel 88 million miles per year, transporting roughly 850,000 students. The average student rider spends about 1.5 hours per day on the school bus, according to the U.S. Environmental Protection Agency (EPA).

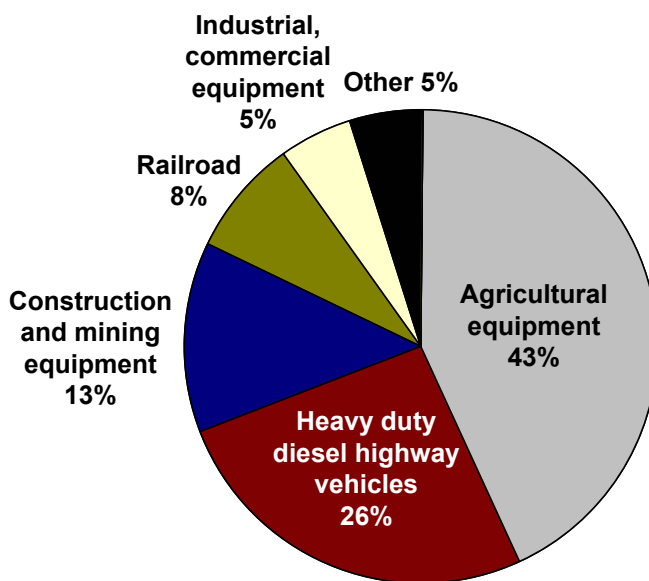
School buses are powered by diesel engines, which are a significant source of fine particle pollution, as well as nitrogen oxide and hydrocarbon pollution, in urban areas.

### Potential health effects

Fine particles, those 2.5 microns or less in diameter or about one-fortieth the width of a human hair, have become a significant health concern nationwide, because air pollution health studies have linked this pollutant with problems such as reduced lung function, the development of chronic and acute bronchitis, asthma attacks, heart attacks, arrhythmias and even premature death. These small particles get deep into the lungs and some can pass into the bloodstream.

High particle pollution levels can trigger asthma attacks in sensitive individuals,

Sources of particulate matter from diesel engines



School buses and other heavy duty vehicles powered by diesel engines can be a significant source of particle pollution in urban areas.

and children and infants are among the most susceptible to these types of air pollutants. Recent studies also show that particles entering the blood can contribute to heart and circulatory diseases in adults.

Recent studies also show that particles entering the blood can contribute to heart and circulatory diseases. Diesel exhaust is a proven carcinogen, and the American Academy of Pediatrics cites an association between diesel exhaust exposure and an increased risk of such serious diseases as lung cancer.

### **New diesel engine standards**

New federal diesel engine standards are scheduled to be phased in beginning in 2007 — cutting emissions from by up to 95 percent. However, older diesel-powered vehicles will remain in use for 15 or 20 years. Poorly maintained or older vehicles emit much more pollution than newer vehicles. More about these standards can be found on the EPA Web site at [www.epa.gov/otaq/diesel.htm#hd2007](http://www.epa.gov/otaq/diesel.htm#hd2007).

### **Retrofits for school bus engines**

One national program that is addressing pollution from older buses that are likely to remain on the road for several more years is Clean School Bus USA. Rolled out by the EPA in 2004, this program offers grants to retrofit bus engines in areas of the country that do not meet federal air quality standards.

Retrofit technology refers to engine system changes that decrease emissions beyond federally-established standards. Most often these changes include installing an exhaust system catalyst (like the catalytic converters found on cars).

Other types of diesel retrofit projects include installing diesel oxidation catalysts (DOCs), closed crankcase ventilation systems, and other filter technologies.

DOCs are stainless steel canisters that are installed in the exhaust system much like a muffler. As exhaust gases pass through the DOC, particulate matter and other pollutants are re-burned, forming water vapor and carbon dioxide. DOCs can be used with regular diesel fuel. They are available for most engines and applications, and generally reduce particulate matter

pollution by about 30 percent. DOCs cost about \$2,000 each.

A closed crankcase ventilation system captures and recirculates emissions from the engine, routing emissions away from the cab of the bus and reducing students' pollution exposure.

Other filter technologies include particle traps. Particle traps can be used instead of DOCs and can cut diesel fine particle pollution by more than 90 percent — however, these devices must be used in conjunction with ultra low sulfur fuels in order to be effective.

But since Minnesota is within these standards, the state does not qualify for federal diesel retrofit grants.

Here in Minnesota, two school districts have already participated in small-scale diesel retrofit initiatives. Mankato schools retrofitted 25 buses, while South Washington County schools retrofitted 71 buses as part of various state and private efforts.

### **ULSD and more**

Nationwide, a great deal of work is underway to reduce diesel pollution from all sorts of vehicles — both on-road vehicles and non-road transportation like locomotives and boats — via EPA's Clean Diesel Campaign. This work builds on a combination of new fuels and new technologies to reduce exhaust pollution. For example, clean, ultra-low-sulfur diesel (ULSD) fuel will be required for use in all highway diesel engines starting in 2006.

Low-sulfur diesel fuel for non-road diesel engines will be required in 2007, followed by ULSD fuel for these machines in 2010, and for locomotives and marine engines in 2012. ULSD fuel is already available in some areas of the country. By 2030, when the engine fleet has been fully turned over and the new fuels are rolled out, particulate matter and nitrogen oxide pollution will be reduced nationwide by 250,000 tons/year and 4,000,000 tons/year, respectively. The EPA estimates that this will result in annual health-related benefits to the U.S. of more than \$150 billion, at a total cost of approximately \$7 billion.

In Minnesota, the MPCA successfully collaborated with the Metropolitan Council to accelerate Metro Transit's adoption of ULSD for all 900 city buses well in advance of federal mandates. And the agency plays a role in Project Green Fleet (see link below), a Minnesota Environmental Initiative project that will help reduce harmful diesel emissions from 500 school buses by at least 40 percent by the end of 2007.

### **For more information**

Private and public sector support for diesel pollution reduction is critical, and your company or organization may be able to help. To find out more, contact Mark Sulzbach at [mark.sulzbach@pca.state.mn.us](mailto:mark.sulzbach@pca.state.mn.us) or call 651-296-7768.

More information about reducing emissions from school buses and diesel engines in general is available on the Web sites below.

- Project Green Fleet  
[www.projectgreenfleet.org](http://www.projectgreenfleet.org)
- Clean School Bus USA  
[www.epa.gov/otaq/schoolbus/index.htm](http://www.epa.gov/otaq/schoolbus/index.htm)
- Cleaning Older Engines  
[www.epa.gov/otaq/retrofit/](http://www.epa.gov/otaq/retrofit/)
- National Clean Diesel Campaign  
[www.epa.gov/cleandiesel/](http://www.epa.gov/cleandiesel/)