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## Reducing Emissions from Shuttle Buses

### What Can Shuttle Bus Fleet Operators Do?

Buses play an important role in transporting people from place to place. They are a key element of public transportation and tourism by making travel convenient and affordable. There is growing concern, however, about the health effects associated with exposure to diesel exhaust. Like other vehicles on the road, buses emit significant amounts of pollution, including carbon dioxide, nitrogen oxides (NO<sub>x</sub>), poisonous carbon monoxide, particulate matter (PM) and air toxics. Not only do these emissions contribute to the formation of ozone smog, acid rain, and global climate change, they also contribute to asthma, heart disease, lung damage, and possibly cancer. This pollution affects everyone, including bus drivers.

Although new emission standards and technology for the diesel and gasoline vehicles of the future will dramatically reduce these health risks, there are three main actions that shuttle bus fleet operators can take now to use less fuel, save money, and reduce pollution.

### Reduce Engine Idling

Idling vehicles emit pollution and waste fuel. Recent studies found that fuel consumption during engine start-up is equal to about 30 seconds of engine idling, if the engine is within normal operating temperature. Therefore, it is more fuel efficient for drivers to turn off the motor than to idle the engine.

An idling bus consumes about one gallon of fuel per hour. If a company operates 50 buses and reduces the idling time of each bus by 30 minutes per day, at \$2.00 per gallon of diesel



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fuel, the company would save over \$18,000 per year in fuel costs.

In addition to saving fuel and reducing emissions, there are legal reasons not to idle. Massachusetts' law prohibits unnecessary idling of all motor vehicles that are stopped for a foreseeable period of time over five minutes. Find out more at: [www.mass.gov/legis/laws/mgl/90-16a.htm](http://www.mass.gov/legis/laws/mgl/90-16a.htm)

### Use Cleaner Fuels

Burning cleaner diesel fuel, or alternative fuels, helps reduce vehicle pollution. Some fuels can be used in a standard diesel engine without any modifications. Others require engine modifications. Some examples of cleaner fuels available in the Boston metropolitan area include:

#### Biodiesel

- Biodiesel is a domestically produced, renewable fuel that can be manufactured from new and used vegetable oils and animal fats. It is safe, biodegradable, and

reduces air pollutants such as fine particles, poisonous carbon monoxide, smog forming hydrocarbons, and air toxics. However, nitrogen oxides emissions increase slightly with the concentration of biodiesel in the fuel. Some biodiesel produces more nitrogen oxide emissions than others, and some additives have shown promise in reducing these increases.

- Blends of 20% biodiesel with 80% petroleum diesel (B20) can be used in regular diesel engines. Biodiesel can be used in its pure form (B100), but may require minor engine modifications to avoid maintenance and performance problems. Pure blends of biodiesel are not suitable for cold climates.
- B20 costs about 20 to 30 cents more per gallon than regular diesel fuel, and reduces emissions of fine particles by about 10 percent. It also reduces emissions of hydrocarbons by more than 20 percent.

Boston Coach has established a strong anti-idling policy for its drivers. To reduce winter warm up time, Boston Coach also created garage space to park their vehicles. By establishing a program to inform your drivers about the Massachusetts Anti-Idling rule and ensuring full compliance with the rule, you can reduce air pollution and save money in fuel costs.

## Emulsified Diesel

Emulsified diesel is a blended mixture of diesel fuel, water, and other additives that reduces both fine particle and nitrogen oxide emissions. Emulsified diesel can be used in any diesel engine, but the addition of water reduces the energy content of the fuel, so some reduction in power and fuel economy can be expected. Case studies suggest that emulsified diesel can reduce emissions of smog-causing nitrogen oxides between 10 - 20 percent and fine particles between 50 - 60 percent. Emulsified diesel costs roughly 20 cents more per gallon than regular diesel fuel.

## Ultra Low Sulfur Diesel Fuel

Ultra Low Sulfur Diesel Fuel (ULSD) will be available nationwide in June 2006, but currently is available in certain parts of the country, including the Boston area. ULSD reduces fine particle emissions between 5 and 9 percent. The combination of ULSD with advanced pollution control technology, such as a diesel particulate matter filter (DPF), reduces fine particle emissions by more than 90 percent. ULSD currently costs between 5 - 20 cents per gallon more than regular highway diesel fuel. In 2006, when ULSD is available nationwide, the cost differential will disappear.

## Compressed Natural Gas

Compressed natural gas (CNG) buses equipped with an oxidation catalyst can

## A number of fleets in the Boston area are operating buses equipped with diesel particulate matter filters:

**MBTA:** Currently, the MBTA is using ULSD in all of its diesel buses and has committed to retrofit all of its existing and new diesel buses with particulate matter filters. The entire diesel fleet will be equipped with particulate matter filters by the end of 2004.

### Medical Academic and Scientific Community Organization (MASCO):

In 2003, MASCO, owners of the shuttle buses that serve the Longwood Medical area in Boston, became the first private fleet in New England to install diesel particulate matter filters and use ULSD fuel in their entire fleet of 17 buses.

**Old Town and Beantown Trolley Tour Buses:** The 34 diesel powered tourist trolleys operating in downtown Boston are equipped with diesel oxidation catalysts and 20 of them are using ULSD fuel.

### Two notable fleets in the Boston area operate CNG buses:

**Massport:** Logan airport is an ideal location for CNG buses, since buses are centrally fueled on site. The 32 shuttle buses at Logan Airport that transport airport passengers and employees among the terminals and to the Massachusetts Bay Transportation Authority (MBTA) Airport Station run on CNG.

**MBTA:** 358 of the MBTA's approximately 1000 buses are fueled with CNG. Three of the MBTA's garages are equipped with CNG refueling and maintenance facilities.



reduce fine particle emissions between 70 to 90 percent, compared to an uncontrolled diesel bus. New CNG buses cost about \$30,000 more than a comparable diesel bus. They also require special refueling and maintenance facilities. Overall the cost of natural gas and diesel fuel are very similar but in some areas of the country natural gas fuel may be more economical.

the catalytic converter in your car and can reduce emissions of PM by between 20 and 50 percent (in certain types of vehicles), hydrocarbons (HC) by 50 percent, and carbon monoxide (CO) by approximately 40 percent. Oxidation catalysts cost between \$1,000 and \$2,000, can be installed on any new or used bus, and run on regular diesel fuel.

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Several fleets in the Boston area use biodiesel, including all of Harvard University's diesel vehicles, which currently operate on B20.

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## Install Pollution Control Equipment

Adding pollution control equipment such as a diesel oxidation catalyst or a particulate matter filter is another way to reduce emissions from buses. These devices are installed in the exhaust system of an existing diesel engine.

- Diesel Oxidation Catalysts  
Diesel oxidation catalysts are similar to

- Diesel Particulate Matter Filters  
Diesel particulate matter filters are ceramic devices that collect PM in the exhaust stream. The high temperature of the exhaust heats the ceramic structure and allows the particles inside to break down (or oxidize) into less harmful components. They cost between \$5,000 and \$10,000, and can be installed on buses built after 1995. To ensure that the filter will work properly, it is necessary to use ULSD fuel with a sulfur content of less than 15 parts per million.