

Cleaning the Air in Canadian Cities

The Problem

One city bus can take 40 vehicles off the road, save 70,000 litres of fuel and keep 168 tonnes of pollutants out of the atmosphere each year.

If public transit is promoted as an environmentally sustainable alternative to private vehicles, it is crucial that it be as “clean” as current technologies allow.

Air pollution takes a great toll on human health and the environment. Transportation is one of the largest sources of air pollution and greenhouse gases in Canada, particularly in urban areas. Large, heavy-duty vehicles such as buses and trucks use diesel engines, a significant contributor to emissions of particulate matter, nitrogen oxides, carbon monoxide and hydrocarbons – all of which are hazardous to human health. Environment Canada has declared particulate matter, especially airborne particulate matter equal to or less than 10 microns (called PM10), toxic under the *Canadian Environmental Protection Act (1999)*.

As our city populations grow and the demand for public transportation increases, so does the need to deal decisively with the emissions from road transport that form smog and acid rain.

Seeking Solutions through S&T

Numerous statistical studies have led scientists to conclude that exposure to air pollution can increase the risk of lung and heart disease.

Across Canada, studies show there are more than 5,000 premature deaths a year that can be attributed to air pollution.

In Ontario alone, during an average year, exposure to air pollution results in an estimated 60,000 emergency room visits and 17,000 hospital admissions.

Working with the Clean Air Strategic Alliance and the City of Edmonton, and in partnership with the province of Alberta and private industry, engineers and scientists from the Environmental Science and Technology Centre (Ottawa) tested the effectiveness of an emission reduction technology, used with ultra-low sulphur diesel, on local city buses in typical Canadian cold weather conditions.

Two City of Edmonton diesel-powered urban transit buses were equipped with continuously regenerating diesel particulate filters, which reduce the particulate matter from engine exhaust, as well as carbon monoxide and hydrocarbons.

To measure exhaust emissions, Environment Canada engineers used a unique portable test unit designed in-house for on-board emission measurements, the Dynamic Dilution On/Off-road Exhaust Emissions Sampling System (DOES2). The DOES2 is mounted onto the test vehicle and allows scientists and engineers to measure and characterize exhaust emissions in a real setting, as a vehicle moves through its normal operating environment.

Exhaust emissions from the city buses were tested for total hydrocarbons, nitrogen oxides, carbon monoxide, carbon dioxide and particulate matter. Results showed the filter significantly reduced emissions of three major pollutants: total hydrocarbons by up to 87 percent; carbon monoxide by up to 89 percent; and total particulate matter by up to 75 percent.

Combined with the use of ultra-low sulphur diesel fuel, diesel particulate filters can significantly reduce the harmful emissions from heavy-duty vehicles including transit buses. Ultra-low sulphur diesel fuel became standard in Canada effective September 1, 2006, in accordance with federal Sulphur in Diesel Fuel Regulations. Important in the Canadian context, the diesel particulate filter performed effectively even in the very cold weather experienced during the test period.

Transforming Knowledge into Action

Who can use these results?

Results produced by “real world” emissions testing can assist municipalities, provinces, transit agencies and private industry in taking action to reduce and control emissions to meet stringent new standards. These emission controls are now common technology on many new urban buses.

Environment Canada has turned its attention to the existing fleet of buses through a program with the Canadian Urban Transit Association to support installation on older buses. This field work is an example of the S&T activities conducted under the *Canadian Environmental Protection Act (1999)* to reduce emissions from in-use vehicles and to support development of new regulations, guidelines and emission factors for mobile sources.



Photo credit: Jeremy Brady

Practical testing also promotes a better understanding of the effectiveness of pollution reduction and control technologies among decision makers and environmental managers, supporting their actions to reduce the impacts of pollutants on human health and the environment.

Benefits to Canadians

A cleaner environment in cities translates to savings in health costs and environmental clean-up costs. A single city transit bus running efficiently can carry as many people as 40 to 50 passenger vehicles, with only 25 percent of comparable emissions. Reducing toxic emissions, such as PM10, from vehicles has positive effects on air quality, smog and climate change, benefiting public health, the economy and the environment. Increased fuel efficiency brings a direct economic benefit to consumers.

On-road vehicles contribute up to 35 percent of the emissions that are involved in smog formation and up to 19 percent of Canada's total greenhouse gas emissions.

A typical diesel-powered vehicle emits 1½ to 2 times as much nitrogen oxide into the air as a comparable gas vehicle. When nitrogen oxide and volatile organic compounds react in sunlight and stagnant air, they form ground-level ozone – the main component of smog.

Diesel engines are major contributors to urban particulate matter, which can carry carcinogens and cause respiratory health problems in people.

In 15 Canadian cities, more than 330 transit buses built between 1990 and 1993 have been retrofitted with Diesel Oxidation Catalysts.



For more information:

Environment Canada Clean Air Online
www.ec.gc.ca/cleanair-airpur/Home-WS8C3F7D55-1_En.htm

Environmental Science and Technology Centre's Emissions Research and Measurement Division
www.etc-cte.ec.gc.ca/organization/ermd_e.html

Environmental Science and Technology Centre's Dynamic Dilution On/Off-road Exhaust Emissions Sampling System (DOES2)
www.etc-cte.ec.gc.ca/organization/mbdo/mbdo_does2_1_e.html

Clean Air Strategic Alliance Clean Bus project
www.casahome.org/?page_id=127

Environment Canada's partnership with Canadian Urban Transit Association on urban bus retrofits
www.ec.gc.ca/cleanair-airpur/default.asp?lang=En&n=2C562D8