

GOVERNMENT BUYER

Volume 4 Number 2
March 2008

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Clean sweep



Toronto cleans up its streets and skies with a new approach to sweeping that keeps particles from being thrown into the air

by Andrew Topf

Toronto's air will be much cleaner thanks to a new street sweeping

program recently implemented by Canada's largest city.

Conventional mechanical street sweepers use a system of gutter brooms and main broom to sweep the dust and debris that typically accumulates on city streets and in gutters. While some of the material is collected by the machine, much of the fine road dust – which originates from asphalt, rubber tires, and wearing of brake discs and pads – kicked up by the sweeper is dissipated into the air, adversely affecting air quality.

Detailed studies of the city's air quality, and a study correlating a decline in air quality with street sweeping, led to the conclusion that improving the system

of street sweeping would result in cleaner air. New street sweepers employing regenerative air technology have vastly reduced the amount of particulate matter (PM10 and PM25) released.

In 2005 and 2006 the City of Toronto purchased a total of 25 regenerative air technology street sweepers at \$270,000 each; the city has authorized \$7 million to purchase 21 more in 2008.

The regenerative-air sweeper employs a technology that re-uses air in a closed-loop system and vacuum suction to pick up dust and other debris. These sweepers are expected to remove 90 percent of PM on city streets, and result in a 21 to 30 percent improvement in air quality.

Health concerns over PMs

The health impacts of poor air quality in Toronto are well-documented. A 2004 report by Toronto Public Health states that air pollution contributes to about 1,700 premature deaths and 6,000 hospital admissions every year. Of those deaths, 1,200 are attributable to chronic exposure to particulate matter. Less serious afflictions such as chronic bronchitis and asthma affect thousands of Torontonians annually.

Vesna Stevanovic-Briatico, Toronto's

transportation coordinator with the Transportation Services Division, explained the rationale for the program.

"The main objectives were to deploy PM-efficient street sweepers that are not only removing particulates from city-paved roads, but are capable of regular sweeping year-round, and also to deliver the street-sweeping service in a manner that would contribute to improved overall human health, air and stormwater quality."

Extensive testing done

In choosing new street sweepers, the city developed and implemented the ground-breaking PM Street Sweeper Efficiency Testing Protocol. The criteria that were established measured how much material was picked up and how much material was disturbed and displaced into the air and onto adjacent right-of-ways. Other factors such as maneuverability, leaves, large debris and heavy accumulation efficiency, and operating during wet conditions were also evaluated under the Operational On-Street Test Protocol.

An aged, two-lane curbed, asphalt road was built inside an enclosed tunnel to trap and measure the disturbed test material. The test material applied to the surface of the road had a median size of

3 microns. Testing was carried out over 15 days evaluating three different sweeper technologies, including eight different sweeper models.

Closed-loop system recirculates air

Regenerative air technology sweepers employ air in a closed-loop system, meaning the air stream is recirculated within the sweeper.

“What happens is the blower in the pick-up head blasts air under pressure to dislodge the material from the surface of the road, the cracks and crevices, and at the same time it applies a vacuum-suction to lift the material,” Stevanovic-Briatico said.

The gutter brooms sweep the debris into the centre of the machine, where a pickup head collects the material pneumatically into a hopper. Water jets, screens, a centrifugal separator and dry dust filtration system cleans the air before returning it to the blower to repeat the process.

The main advantage from mechanical sweepers is the particulates are captured within the machine itself and the disturbance of particulates into the air is minimized. Another advantage is the gutter broom speeds can be regulated and moved closer to the pickup head, thus even further minimizing dust disturbance.

“The centrifugal force, dry dust filtration system and the powerful vacuums minimize the disturbance of dust. Also we can use the regenerative air sweeper without an ounce of water, where other sweepers, if you don’t use water in the hopper, or on the gutter broom, you will have a cloud of visible or invisible dust surrounding the sweeper,” said Stevanovic-Briatico.

She said a significant plus of the new sweepers is their ability to operate year-round, even in the winter and in conditions of light rain. Other types of sweepers typically can only operate in dry weather or must use water for dust suppression.

Stevanovic-Briatico says the only drawback is the machines come with a double engine, so the fuel costs are higher than the single-engine mechanical sweepers. With few moving parts, the savings in maintenance costs are expected to offset the higher fuel costs, and the tailpipe emissions from the machines are insignificant compared to the reductions in airborne particulate matter. She estimates the new sweepers will remove an annual 14 tonnes of PM off city streets.

Toronto practices drive industry

Toronto has a detailed training and follow-up plan with the eventual goal to develop a code of best practices for the street sweeping industry.

“What Toronto has developed is a tool that municipalities can use to can evaluate the air quality efficiency and operational performance of the sweeper quantifiably and objectively,” said Stevanovic-Briatico. The city is working with Environmental Technology Verification (ETV) Canada and the Prairie Agriculture Machinery Institute (PAMI) to move to third-party testing, which would make Toronto’s testing protocol available to sweeper manufacturers. Several companies have undertaken their own R&D and have expressed an interest in getting verified under the ETV program.

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