

ENVIRONMENT COMMITTEE – NOVEMBER 26, 2007

NEW STREET SWEEPER – CAPITAL PROJECT FL-5037-07

Recommendation

The Commissioner of Engineering and Public Works recommends that the City adopt the following standards with respect to Particulate Matter 10 (PM10), and Particulate Matter 2.5 (PM2.5) removal efficiency for its street sweeping fleet, and that all new street sweepers purchased by the City:

- meet PM10 and PM2.5 90% removal as outlined in the City of Toronto's Street Sweeper Test Protocol
- be able to sweep in seasonal periods when temperatures are below zero celcius without the need for water
- have a dry dustless filtration mode
- have results verified by the Government of Canada's Environmental Technology Verification Program

Economic Impact

Funding for a new street sweeper was approved as Capital Project FL-5037-07 Public Works - Street Sweeper. There are sufficient funds in this account to purchase a street sweeper that will meet these requirements.

Communications Plan

Once approved and tendered, the Public Works Department will work with Corporate Communications to ensure that the public are made aware of the City's new sweeping technology that will help improve overall air quality in the City.

Purpose

To advise the Environment Committee with respect to new street sweeping technology, and ensure that the newest, and all future street sweepers purchased by the City, meet PM10 and PM2.5 removal as part of the City's overall commitment to the environment.

Background - Analysis and Options

In 2001, the City's Public Works Department recommended that sand be eliminated as part of its winter maintenance program in urban areas. The reasons were many, but of particular note was the fact that studies indicated that sand contributes to a high airborne particulate matter (PM), which is inhaled and can cause respiratory problems. The research in Albany, NY, Denver, CO, and Reno, NV studied the impact of sanding on ambient particulate loadings and found that sanding contributed from 44% to as high as 75% of the total PM. As a result of the report presented in 2001, Vaughan Council approved this change.

At that time, the study of PM was well underway and new standards were developed for street sweeping operations in Denver Colorado as well as other U.S. cities a result of these studies. In May of 2000, the Canadian Environmental Protection Act (CEPA), identified PM10 as a "toxic" substance, and PM2.5 as a major and common determinant of poor air quality and smog days.

In 2004, the City of Toronto's Public Health Department published a report in stating that approximately 1,200 premature deaths are attributable to PM2.5, and approximately 180 deaths per year could be attributed to PM10 in Toronto.

Given the population difference, this could translate into approximately 120 and 18 deaths respectively for Vaughan, assuming similar air quality conditions existed.

PM₁₀ refers to particulate matter that is 10 microns in size and PM_{2.5} refers to particulate matter that is 2.5 microns in size. These are particles that are smaller than the width of a human hair, and are not visible to the human eye. The Toronto study shows that on the average city street, this matter is found in the air at a height that is normally less than 2 metres off the ground

In 2004, the City of Toronto established a PM₁₀ and PM_{2.5} Street Sweeper Testing protocol. As part of the "Clean Roads to Clean Air" (CRCA), project, the groups found that fine road dust originates mostly from asphalt, rubber tire, and brake and disc wear, and that removing much of the fine dust could lead to an improvement in the City's air quality.

An enclosed test facility was constructed to test eight sweeper models that were on the market. The outcome of the tests allowed staff to determine the performance efficiency for factors such as:

- Removal of Material from Test Surface (the amount picked up and removed)
- Material Disturbed and deposited elsewhere (deposited on sidewalks, lawns etc.)
- Material Disturbed into the air (PM₁₀ and PM_{2.5} concentrations)

The CRCA group conducted numerous studies in a controlled and real world environment, and studied various types of mechanical, vacuum and regenerative air type street sweepers. Testing was also done to see if the sweepers could meet the City's clean air objectives by sweeping when daytime temperatures are below zero, and water could not be used, as well as during the numerous "Smog Alert" days in the summer.

The result of 15 days of testing showed that the regenerative air models achieve the highest efficiency performance for both PM₁₀ and PM_{2.5} in all three areas.

The test showed that the regenerative air technology could achieve greater than 90% surface removal efficiency, material deposit on sidewalks as low as 0.07%, the lowest PM₁₀ air contamination concentration, as well as the lowest PM_{2.5} air contamination concentration.

In addition to the controlled tests, Toronto staff also conducted on-the-road tests to determine:

- Efficiency in leaf and heavy silt loading pick-up
- Efficiency of large debris pick-up
- Ability to operate during wet conditions (rain)
- Ability to operate at temperatures below zero celcius
- Ability to operate in a dry, dustless mode.

Again, the latest style regenerative air type sweeper scored the highest ratings.

In 2005, the City of Toronto adopted new standards for street sweepers that take into account the removal of PM. Since that time, numerous other cities have adopted similar specifications for their street sweepers, including, Hamilton, Ottawa, and Kingston.

The City of Vaughan's Public Works Department currently uses two mechanical type street sweepers mounted on conventional truck chassis. These machines use a large main broom to sweep up the debris onto a conveyor belt which takes the material up into the hopper. These machines are not effective in the removal of the hazardous fine dust. In fact, the sweeping action of the main broom can actually fill in cracks in the road with this material.

These machines are not very efficient at leaf collection in the fall either, as the material tends to build up faster than the conveyor can take the material, resulting in large mounds of leaves being left in the middle of the road.

Vaughan Public Works staff have also had demonstrations of vacuum type sweepers as well. These units have a main broom that transfers material over to the vacuum head. However, only the area under the vacuum head is actually efficiently cleaned. The contaminated air used in the vacuum process is exhausted back into the air without any filtration for PM.

Regenerative air technology uses air that is “swirled” and creates a cyclone effect to blast dirt and debris from the road surface, and this air goes through a series of screens and filters where the debris is removed before the air is re-circulated to the road surface again. This type has a full-width pick-up head that provides containment of dislodged debris from the cracks in the road surface. A standard regenerative air sweeper requires water for dust suppression and can leave material on the road surface if the seal is broken between the head and the road surface. However, the latest type of regenerative air sweeper has automatic dry dust filtration that allows for increased vacuum in the pick-up head, and has the highest PM removal, and does not require water for sweeping in dry conditions.

Vaughan Public Works recently had a demonstration of one of the latest regenerative air type street sweepers, and tested it in both dry and wet leaf conditions. In both cases, the performance of this type of sweeper could not be matched by either the City’s existing fleet of mechanical sweepers, or the vacuum type sweepers also tested to date. Latest generation regenerative air sweepers also have reduced operating costs as there are no conveyors to replace, and there are no grease points on the sweeper itself to worry about.

In addition to the obvious environmental and sweeping advantages that the latest regenerative air sweepers can provide, being able to sweep without water helps the City maintain a good public image when Stage 1 and Stage 2 Water Advisories are in effect. In addition, our tests to date show that these units are more efficient at picking up leaves than either mechanical or vacuum type sweepers due to their technology and large pick-up head.

As a result of the findings done by numerous jurisdictions, including the City of Toronto and tests done by Vaughan Public Works, it is recommended that when Capital Project FL-5037-07 is tendered, it must:

- meet PM₁₀ and PM_{2.5} 90% removal as outlined in the City of Toronto’s Street Sweeper Test Protocol
- be able to sweep in seasonal periods when temperatures are below zero celcius without water
- have a dry dustless filtration mode
- have results verified by the Government of Canada’s Environmental Technology Verification Program

Relationship to Vaughan Vision 2007

By adopting the recommendations contained in this report, it achieves the following Vaughan Vision objectives:

- A-1 “Pursue Excellence in Service Delivery”
- A-2 “Enhance and Ensure Community Safety, Health & Wellness”
- A-3 “Lead and Promote Environmental Sustainability”
- C-2 “Enhance Productivity, Cost Effectiveness and Innovation”
- C-3 “Maintain Assets & Infrastructure Integrity”

Regional Implications

N/A

Conclusion

As speakers and participants in the annual Smog Summit, it is important for the City of Vaughan to take overall air quality into account, especially when performing routine road maintenance operations such as street sweeping.

By adopting the recommendations contained in this report, the City will be taking steps to remove hazardous particulate matter from the air, thereby improving the overall air quality in the City. In addition, by adopting these minimum requirements, it will result in the City obtaining a sweeper that is more versatile in terms of its ability to sweep in periods of water restrictions, better at leaf collection in the fall, and can operate during periods of cold weather when water for dust control would not be practicable due to freezing temperatures.

Attachments

N/A

Report prepared by:

Brian T. Anthony

Respectfully submitted,

Bill Robinson, P. Eng.
Commissioner of Engineering And Public Works

Brian T. Anthony, CRS-S,C. Tech
Director of Public Works