TORONTO

STAFF REPORT
ACTION REQUIRED

Small Engine Equipment (Two-Stroke Engines) Greening Strategy for City Operations and the Broader Public

Date:	May 1st, 2009
To:	Executive Committee
From:	Richard Butts, Deputy City Manager
Wards:	All
Reference Number:	P:\2009\Cluster B\TEO\EX09002

SUMMARY

Small engine equipment, such as lawn mowers, string trimmers, chain saws and leaf blowers, is widely used in maintaining City parks, trees, landscaped areas of the road allowance and other City-owned sites. The general public, businesses and other institutions (eg. school boards, universities and other levels of government) also rely upon this equipment to maintain their properties. Emissions from older, inefficient two-stroke equipment contribute to poor air quality and the release of greenhouse gas.

As part of the Climate Change, Clean Air and Sustainable Energy Action Plan, City Council directed staff to develop an emission reduction strategy for small engine equipment. This report recommends an accelerated timeline to replace less efficient equipment used in City operations, along with changes to current business practices that will further reduce emissions. The report also outlines an emission reduction strategy for equipment used by the broader public, businesses and other institutions.

The strategy for City operations is comprised of an accelerated equipment replacement schedule for the principal users of the equipment, Transportation Services and Parks, Forestry and Recreation Divisions. The recommendations are based on a consultant's independent review of greener alternative technologies and practices with consideration to emission reduction potential, the City's operational imperatives and cost effectiveness.

The strategy for the broader public, businesses and other institutions is to focus on public education and incentives, including the expansion of an existing buy-back incentive program for older equipment. Staff will report back in 2009 on the success of the public education and incentive program and the results of further stakeholder consultation on options to accelerate the phase out of inefficient small engine equipment.

RECOMMENDATIONS

The Deputy City Manager recommends that:

1. The General Managers of the Parks, Forestry and Recreation and Transportation Services Divisions implement the accelerated small engine equipment replacement strategy outlined in this report and according to the timeline in Appendix 2;

2. The additional operating funds required to implement Recommendation 1 be included for consideration in the Parks, Forestry and Recreation Division's 2010 operating budget submission;

3. The General Managers of the Parks, Forestry and Recreation and Transportation Services Divisions, in consultation with the Director of the Purchasing and Materials Management Division, develop small engine equipment (non/off road small spark ignition engine, under 19 kW) purchasing specifications that take into consideration the following:

   (i) all new small engine equipment purchased by the City should meet or exceed, where applicable, the current phase small engine emission standards of Environment Canada or the US Environmental Protection Agency (EPA), whichever is more stringent;

   (ii) all City contracts for outside work should specify that small engine equipment meets or exceeds, where applicable, the current phase small engine emission standards of Environment Canada or the US EPA, whichever is more stringent, or that the bidder or proponent have a plan in place prior to award of contract, to replace non-compliant current small engine emission equipment during the contract duration and use cleaner alternatives that meet or exceed the Environment Canada or US EPA standard, whichever is more stringent.

4. The General Managers of the Parks, Forestry and Recreation and Transportation Services Divisions be authorized to donate retired small engine equipment that would normally go to auction to the Clean Air Foundation and the Recycling Council of Ontario for environmentally responsible disposal;

5. The General Manager of the Parks, Forestry and Recreation Division continue to refine park design and maintenance standards and alternative landscaping practices to reduce the use of small engine equipment in operations;

6. The City Manager request that the Director General, Legislative and Regulatory Affairs, Environment Canada, review existing standards under the Canadian Environmental Protection Act for the import of small engine equipment to ensure that all Canadian standards meet or exceed the US EPA standards and that all individual products imported into Canada meet the minimum emission standard of the US EPA;

7. The Director, Toronto Environment Office, work with other City Divisions and Agencies, Boards and Commissions that use small engine equipment to ensure that emission reduction strategies are developed and implemented;

8. The Director, Toronto Environment Office, in consultation with the Medical Officer of Health, develop and implement an education campaign for the general public, businesses and other institutions with the goal of reducing use of polluting, inefficient small engine equipment and raising awareness of the negative environmental impacts of older equipment and benefits of alternative technologies and practices;

9. Council authorize the Director, Toronto Environment Office, to partner with the Clean Air Foundation and deliver the "Mow Down Pollution" program at Councillor Environment Days beginning September 2009, providing for responsible disposal of polluting small engine equipment and incentives to purchase greener alternatives; and

10. The Director, Toronto Environment Office, undertake a public engagement process with representatives of landscape and yard maintenance businesses, other interested stakeholders and members of the general public regarding additional options and measures to advance the phase out of older inefficient small engine equipment and report back in 2009.

Financial Impact

The Parks, Forestry and Recreation and Transportation Services Divisions currently allocate a combined $104,000 for small engine equipment replacement annually, drawn from their operating budgets. The current base budgets for small equipment replacement in Parks, Forestry and Recreation and Transportation Services are $86,000 and $18,000, respectively.

The recommended strategy would accelerate replacement of less efficient equipment and establish new ongoing base operating budgets for small engine equipment replacement in Parks, Forestry and Recreation and Transportation Services that total $176,000, beginning in 2010. The new base budgets will allow for the replacement of equipment according to its appropriate service life.

In 2009, the Toronto Environment Office will contribute one-time funding of $49,100 drawn from account CCL001-04 to accelerate replacement of the least efficient equipment. In 2010, Parks, Forestry and Recreation will submit an enhanced funding request of $58,000 for consideration in the 2010 operating budget process, bringing their base budget for small engine equipment to $144,000. For Transportation Services, an additional $14,000 required to implement the strategy can be accommodated from within the Division's 2009 operating budget. The base budget for equipment replacement will be adjusted to $32,000, starting in 2010.

Funding for the proposed public education and incentive program is available within the Toronto Environment Office's 2009 operating budget as part of the LiveGreen Toronto

outreach program in the amount of $35,000. Following evaluation of the success of the program, any additional funding requests for continuation of the education and incentive program in 2010 would be made as part of the Toronto Environment Office's 2010 operating budget submission.

The Deputy City Manager and Chief Financial Officer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

In July 2007, City Council adopted the report entitled, "Climate Change, Clean Air and Sustainable Energy Action Plan."

The report included, among other recommendations, the following recommendations that relate to small powered equipment:

9 i): direct the General Manager of Parks, Forestry and Recreation and the General Manager of Transportation Services to report back on a proposal to phase out the use of equipment powered by two stroke engines (for example leaf blowers and lawn mowers) by 2009, by continuing to develop and establish landscaping and maintenance techniques that eliminate the need for equipment powered by small engines and shifting to the use of equipment powered by alternative technologies;

4 j): direct the Executive Director of Municipal Licensing and Standards, in consultation with the Medical Officer of Health to report back in 2008 on a plan to potentially ban the use of two stroke engines in powering home and garden equipment by 2010.

ISSUE BACKGROUND

Two-stroke Engines, Air Quality and Green House Gas Emissions

The two-stroke engine design emits pollutants because the process causes partially combusted fuel products to discharge into the air. Air pollution is a significant concern in Toronto. Toronto Public Health estimates that poor air quality contributes to 1,700 deaths and 6,000 hospitalizations each year in the City. Compared to many other types of gasoline-powered equipment, older two-stroke engines emit high levels of air pollutants in their exhaust because the engine oil does not completely combust.

Equipment Used in City Operations

Small powered equipment (mainly two-stroke engine technology) is heavily relied upon for maintenance operations by staff in Parks, Forestry and Recreation and Transportation Services because of the equipment's high power to weight ratio and functionality in various orientations. Prime examples are chainsaws used for tree pruning and string

trimmers that are used to trim turf areas along pathways and horticultural beds. The equipment is also used sometimes in contracted work such as tree removal and road work.

An inventory prepared for the purpose of the greening strategy indicates that staff in the Parks, Forestry and Recreation and Transportation Services Divisions use approximately 1380 pieces of two-stroke equipment in their operations including: 208 mowers and 431 string trimmers (landscaping and turf maintenance), 343 chainsaws (tree maintenance and shrub pruning) and 192 leaf blowers (cleanup of sawdust from tree maintenance activities and leaf cleanup along walkways and other heavily used areas in parks). The full inventory of equipment used in City operations is summarized in Appendix 1.

In several instances, City Divisions have already switched from older two-stroke engines to cleaner alternative technologies. This report recommends an acceleration of that process. The inventory in Appendix 1 and the strategy outlined in this report do not include greener equipment that the City has already purchased. In 2008, Parks, Forestry and Recreation replaced about 10%, of its small engine equipment, purchasing the following equipment that complies with the most stringent United States Environmental Protection Agency emissions standards recommended by this report: 34 mowers, 93 string trimmers, 6 leaf blowers, 11 snow blowers, 2 ice edgers, 12 chain saws, 2 brushcutters and 4 pole pruners.

Based on estimated usage and the approximate age of the City's equipment, the yearly emissions from the inventory of two-stroke engine equipment used by Parks, Forestry and Recreation and Transportation Services are estimated to be 1,273,500 Kg of carbon dioxide and 83,900 Kg of hydrocarbons and nitrous oxide.

Equipment Used by Businesses, other Institutions and the General Public

Small engine equipment is also relied upon by private landscaping companies and other contractors, healthcare and educational institutions, groundskeepers for large apartment complexes and some single family home owners. There is no available estimate of the number of pieces of two-stroke engine equipment in use or the total estimate emissions from two-stroke engine use among these groups.

As an indication of how much equipment may be in use among residents, the Clean Air Foundation estimates that since 2001 it has collected and retired about 2000 pieces of older small engine equipment in the Toronto region through delivery of the "Mow Down Pollution Program." The recommendations in this report will help to extend the reach of this successful program.

Small engine equipment becomes more polluting as it is stretched beyond its recommended service life meaning that accelerated replacement with greener, cleaner technologies is greatly beneficial, particularly since emissions standards have rapidly improved over the last decade (see Tables 1 and 2 below). For example, a 2001 report from the Medical Officer of Health illustrated that a piece of two-stroke equipment from

the year 2000 may emit as much as 498 times as many hydrocarbons, 49 times as much particulate matter and 26 times as much carbon monoxide as a car from the same year. The equipment currently in operation by the City is significantly newer and cleaner than the year 2000 models but older equipment of this vintage still may be in use among businesses, other institutions and members of the public.

Phase 1 Consultant's Study

The first step in developing the small engine equipment greening strategy was to better understand the range of options available to the City. The Toronto Environment Office, with the support of a staff working group consisting of Parks, Forestry and Recreation, Transportation Services, Municipal Licensing and Standards, and Toronto Public Health issued a proposal call for a consultant study in September 2008. A consulting team from Jacques Whitford Ltd. in partnership with Environmental Management and Landscape Architecture were retained to provide recommendations to reduce emissions from two-stroke engine equipment, including:

- an evaluation of technological alternatives to two-stroke engines;
- an investigation of alternative landscape practices and business practices to reduce or eliminate the use of small powered equipment; and
- a review of regulations, policies and standards related to two-stroke engine equipment in Toronto, Canada, the US, Europe and Australia.

COMMENTS

EQUIPMENT GREENING STRATEGY FOR CITY OPERATIONS

Greener Alternatives to Two-Stroke Engines

The consultant's report identified and studied a range of proven technological alternatives to two-stroke engines used in City operations. After initial consultation with staff, some green alternatives were discounted for use because they would not allow the City to meet its operational needs. For example, manual push mowers would add significant labour costs and delays in parks maintenance and are not ergonomically appropriate for the long duration that City staff would use them. Solar and battery powered equipment were discounted out of concern for reliability and insufficient engine power to complete required tasks in light of the vast size and scale of City parks and road allowance operations. Electric corded equipment was discounted due to safety concerns with cords and the remote nature of the City's operations, lacking access to power outlets at most work sites.

After this initial assessment, the technological options under consideration for City operations included the following (each is discussed in more detail in Appendix 2):

- Four-Stroke Engines:
- Four-Stroke Mixed Fuel Engines

- Modified Four-Stroke Engines
- Modern Two-Stroke Engines
- Stratified Charge Two-Stroke Engines
- Catalytic Converters

For each piece of equipment in the City's inventory, the consultant undertook an analysis to determine the preferred alternative replacement technology. This was done by assigning priority weighted values to a range of considerations including: ergonomics, sound levels, air emissions, equipment power, size and weight, power supply, effort to maintain, operation method, the time to complete the task and purchase costs. The weighted values were generated through consultation with City staff to ensure it reflected the City's priorities. The consultant then rated each alternative piece of equipment according to the various considerations and created a decision matrix that compared the scores of each alternative.

Recommended Equipment Replacement Schedule

Based on the review of the available modern alternatives, City staff analysed various options to replace polluting less efficient small engine equipment. The analysis included consideration of the expected service life of existing equipment, experience with equipment maintenance, changing regulatory standards for small engine equipment, the estimated emission reductions and the cost implications for the City's operating budget.

If the City continued to replace equipment at its current rate, the older two-stroke equipment would not be fully replaced until 2018, which is well beyond the recommended service life for many of the pieces of equipment. This option is not recommended because the City will not satisfy the direction of the Climate Change, Clean Air and Sustainable Energy Action Plan to reduce emissions. Full immediate replacement of the equipment would cost an estimated $855,000. This option is not recommended because the budget pressure would be too onerous in 2010 and it would put us in the situation of having to replace all of this equipment at once again in 5-7 years time. Improving emissions standards in 2010, 2012 and 2013 favour the more gradual approach to achieve the maximum emissions reductions that this report recommends.

Based on the analysis, an accelerated replacement schedule is recommended to replace all older less efficient small engine equipment by the end of 2013, representing a substantial emissions improvement over the business-as-usual baseline and a manageable operating budget pressure (discussed below). Rotary mowers, string trimmers and pruning chainsaws would be prioritized for replacement since this will provide the greatest emission reductions. This was determined by comparing the estimated usage of each piece of equipment in the inventory times its relative emission factor. The implementation schedule for the recommended alternative technologies is summarized in Appendix 2**.**

Emissions Improvements from Recommended Approach

Under the proposed five-year accelerated replacement strategy, emissions of hydro carbons and nitrous oxide would reduce by approximately 49,500 Kg and emissions of carbon dioxide would be reduced by 133,600 Kg, compared to 30,000 Kg and 80,400 Kg respectively for the business-as-usual baseline and 48,000 Kg and 129,800 Kg from full immediate replacement. The charts in Appendix 3 provide additional detail on the expected emissions reductions from implementation of the proposed strategy. The estimated emissions reductions for each year from 2010 – 2014 are calculated by comparing the anticipated emissions from new equipment purchased in the previous year with the avoided emissions from the older equipment that will be retired. For example, the 2010 emissions reductions are achieved through the equipment replacement that occurs in 2009.

Other Advantages of the Recommended Approach

In addition to the emission reduction advantages, the recommended approach will avoid a large immediate budget pressure by replacing all of the equipment at once and will be advantageous for ongoing equipment maintenance. The approach will allow for more testing of unfamiliar equipment and adjustment to unanticipated maintenance challenges. It will also allow for implementation of newer cleaner technologies as they come on to the market whereas a one-time full replacement would lock the City in to a particular make and model. Finally, the gradual approach will allow for the establishment of a regular replacement schedule following the service life recommended by manufacturers. Based on usage and equipment warrantees, approximately 20% of the City's small engine should be replaced annually. The City currently replaces equipment at a rate of approximately 10% meaning that older less efficient equipment is kept in operation well beyond its appropriate retirement date. Replacing equipment more regularly will ensure that it performs to its designed emission standards.

Alternative Landscaping Practices

The consultant's study reviewed existing Parks, Forestry and Recreation Division's landscaping practices and provided supplementary recommendations to reduce small engine equipment use. Some of the Division's current planning and design initiatives that reduce the need for small engine equipment in maintaining our parks include:

- expansion of naturalized park areas that require very little maintenance in terms of mowing and trimming;
- converting appropriate park turf areas to community gardens and horticultural beds and;
- implementation of new park designs that help to eliminate or reduce mowing and trimming in corner areas and along edges of parks.

Other current parks maintenance and landscape practices that reduce the overall usage of small engine equipment include:

- an ever expanding integrated plant health care program that helps to control invasive species and the rate of growth of turf, using approved pesticides in compliance with the new Provincial Pesticide laws and regulations;
- differential mowing and trimming regimes that are tailored to seasonal growth cycles, wet or drought conditions, the nature of the recreational uses and the particular growth rates of City parks;
- mulching around trees, shrubs and horticultural beds to reduce the use of string trimmers;
- planting conifers in clumps (where feasible) to avoid mowing between them;
- reduced grass clipping and autumn leaf removal (especially in more passive areas, ravines and naturalized areas, where leaves are not removed);
- use of mowers with high-lift mulching blades on all regular cutting cycles to return leaf organic matter to the soil and eliminate need for leaf blowing in park turf areas;
- use of hand brooms and rakes in small or hard to reach areas; and
- use of hand tools for weeding of horticultural beds.

Additionally, in newer parks and those that have been refurbished, staff have installed benches, tables and waste receptacles on pads to prevent weed and turf growth underneath these elements. Newer walkways, patios and paths are constructed of hard surface materials to prevent weed growth. All City Divisions are also required to develop and implement annual Smog Plans that must comply with smog alerts, that is, small powered equipment must not be used during smog alert days. Additionally, City staff are trained to not let small engine equipment idle when not in use.

Building on the small engine equipment replacement strategy, the Parks, Forestry & Recreation Division is refining its practices, including its park design, landscaping and maintenance standards in an effort to green its operations and reduce energy consumption by using its fleet of small engine equipment more efficiently and effectively. To this end, the Division is expanding its naturalized areas and integrated plant healthcare programs, expanding the community garden program across the City and reviewing all current landscape maintenance and horticultural practices, with a view to improving standards and service levels and reducing the use of small engine equipment.

Regulations and Standards

Emission standards in Canada for small engine equipment are regulated under the 1999 Canadian Environmental Protection Act ("CEPA") and generally follow the U.S. EPA's standards. The exception is that CEPA standards for the smallest engine classes (non-handheld engines classes with less than 100 cc displacement) are lower than the EPA standards. In the City's inventory of equipment, this would affect push string trimmers, rototillers, brushcutters and cart saws.

Most small engines sold in Canada are imported from the U.S. and are therefore EPA certified. However, the EPA provides a mechanism for less efficient equipment to be certified if it is part of a manufacturer's family of equipment that "on average" meets the emissions standards. This averaging formula allows individual pieces of equipment that do not meet the EPA emissions standards to still be sold in Canada. This report recommends that the Federal government close these loopholes so that the Canadian standards are raised and only equipment that meets or exceeds the US EPA's highest emissions standards may be purchased in Canada.

In general, the standards for two-stroke equipment have improved greatly over the past decade. To illustrate this general trend, the US EPA standards for hydrocarbon and nitrous oxide emissions from a small Class IV (i.e., hand blower), a larger Class V (i.e., a limbing chainsaw) and a larger Class I (i.e., a lawn mower) engine are summarized below in Table 1. With regards to emissions of hydrocarbons and oxides of nitrogen, the Class IV standard has improved by 80 % since 1997, the class V standard has improved by 56% and the class I standard is scheduled to improve by 38% by 2012. The US EPA has not regulated emissions of CO2 from small engine equipment in previous years but the organization has done engine testing and has provided a methodology for estimating the emissions for various ages and sizes of engines. The estimations calculated by the consultant are summarized below in Table 2.

Table 1: Selected US EPA Small Engine Standards, HC + NOx Emissions (g/kW-hr)

Equipment Class	1996	2001	2007	2010	2012
Class IV (20-50 cc) handheld	246	196	50	50	50
Class V (> 50 cc) handheld	166	166	72	72	72
Class I (100 – 225 cc) non-handheld	16.1	16.1	16.1	16.1	10

Table 2: Estimated CO2 Emissions based on US EPA Engine Testing (g/hp-hr)

Equipment Class	1996	2001	2007	2010	2012
Class IV (20-50 cc) handheld	1143	1140	1140	1104	1104
Class V (> 50 cc) handheld	824	876	727	727	727
Class I (100 – 225 cc) non-handheld	n/a	n/a	1307	1103	1103

Environmentally Responsible Procurement

City Council has adopted an environmentally responsible procurement policy. The recommendations in this report help to ensure that purchasing decisions for small-engine equipment fit with the City's green procurement policy goals.

Specifically, this report recommends that the least efficient and most polluting equipment be replaced with green, cleaner alternatives. As part of the purchasing tender specifications, new equipment purchased by the City or used in City contracts would be required to meet or exceed the highest current engine emission standards of Environment Canada or the US Environmental Protection Agency, whichever is more stringent. Staff

in Parks, Forestry and Recreation and Transportation Services would work with the Purchasing and Materials Management Division to ensure that appropriate language and specifications are developed for inclusion in contracts so that the purchasing process prioritizes low-emission technologies over cheaper, more polluting alternatives. To verify compliance with this requirement, bidders would be required to provide certification that their equipment meets or exceeds the applicable emission limits.

Further, to reinforce this direction and ensure that all new equipment purchased in Toronto meets the most stringent emissions standards, the report also makes recommendations that the City request the Federal Government to revise Canadian standards for small engine equipment to meet the minimum US EPA standards. Similarly, the recommendation also requests that the Federal government consider changing its importing rules so that less efficient equipment that has been certified by the EPA through an "averaging" formula without actually meeting the minimum EPA emission standard be prohibited from entering Canada.

Use of Premium Fuel for Small Engine Equipment

As part of the greening strategy, the City will move towards the use of premium fuel. Most gas powered equipment manufacturers recommend that premium gasoline and oil be used to prolong the life of the equipment and minimize emissions. Small engines are typically designed for use with premium fuel and do not have electronic engine management systems to compensate for environmental changes. Premium fuels in Canada contain more octane, less ethanol and less sulphur, thus maintaining peak efficiency and lowering emissions. Premium fuels also emit lower exhaust by controlling pre-ignition, excess heat and incomplete combustion. Finally, maintenance intervals and shop time are reduced by engines running cleaner and longer between service intervals.

Currently, fueling stations at City yards provide only regular gasoline and staff in Parks, Forestry and Recreation and Transportation Services are not able to purchase premium fuel from retailers. Providing premium gasoline at City facilities would be costly because it would require the installation of separate tanks. Therefore, as part of the small engine equipment greening strategy, staff in the Transportation Services and Parks, Forestry and Recreation Divisions will work with the Purchasing and Materials Management Division to ensure that those responsible for maintenance of small gas powered equipment are able to purchase premium oil and gasoline from retail outlets.

Environmentally Responsible Equipment Disposal

The City of Toronto Legal Division advises that, based on the Toronto Municipal Code, Chapter 195, Purchasing, materials or equipment which are deemed surplus to divisional or corporate requirements may be disposed of (1) by public auction or solicitation deemed appropriate by the Chief Purchasing Official in the circumstances, or (2) by way of trade-in at fair market value as part of the acquisition of other materials or equipment, or (3) as Council may otherwise authorize. This report recommends that Council authorize staff to retire older polluting equipment so that it is not reused elsewhere.

As part of the agreement with the Clean Air Foundation (discussed below) the City would dispose of all old equipment with environmentally responsible methods. Traditionally, the practice with older equipment has been to offer it at public auctions with the nominal revenue generated flowing back to current fleet maintenance. As part of the small engine equipment greening strategy, the City would partner with the Clean Air Foundation and the Recycling Council of Ontario to ensure that older equipment is retired with valuable materials salvaged for recycling and re-use.

Financial Impact of the Recommended Replacement Schedule

The Parks, Forestry and Recreation and Transportation Services Divisions currently spend approximately $104,000 annually on small engine equipment replacement. The recommended approach would accelerate the replacement of older equipment and establish new base operating budgets for small engine equipment replacement totalling $176,000, beginning in 2010.

In 2009, the Toronto Environment Office will provide one-time funding of $49,100 to help accelerate the replacement of the most polluting equipment in the City's inventory. These funds are available in capital account CCL001-04.

In 2010, the accelerated replacement schedule would require an increase of $58,000 in the base operating budget of Parks, Forestry and Recreation for small engine equipment replacement. This amount will be submitted for consideration as part of the 2010 operating budget process. The current base budget for small engine equipment replacement in Parks, Forestry and Recreation is $86,000 and the enhanced funding request would bring the base budget to $144,000.

Transportation Services currently has a base budget of $18,000 for small engine equipment replacement. To implement the accelerated replacement schedule, an additional $14,000 can be accommodated from with funding allocated in the 2009 operating budget and the base budget for small engine equipment will be adjusted to $32,000 beginning in 2010.

Toronto Zoo started to upgrade its small engine equipment (two-stroke engines) to four-stroke engines in 2006, with the last two-stroke engine equipment replaced in 2008. No additional funding will be required in 2009 or future years for this initiative at the Zoo. At Exhibition Place, grounds keeping is performed by Parks, Forestry and Recreation on a contract basis. Increased charges to Exhibition Place may be required as increased costs are allocated by Parks Forestry and Recreation.

There are no additional budget pressures anticipated from the operation of the newer replacement equipment, the disposal of older equipment, the use of premium fuel and oil or the refinement of park design and maintenance standards and alternative landscaping practices.

THE GENERAL PUBLIC, BUSINESSES AND OTHER INSTITUTIONS

Exploring a Ban on Two-Stroke Engines

City Council directed Staff to report back on potentially banning the use of two-stroke engines in powering home and garden equipment. While the City may have the authority under the City of Toronto Act to impose a ban on the use of certain types of highly polluting two-stroke engines if an environmental or health rationale can be established, a ban is not recommended at this time for the following reasons:

- The rapid improvement in emissions standards for modern small engine equipment, including two-stroke engines, would make it difficult to justify a ban based on the "two-stroke" engine type;
- The Federal Government currently regulates emission standards of small engine equipment. This report makes recommendations to the Federal Government that it raise the Federal standards. This will help to ensure that new equipment purchased and used in the Toronto area is cleaner and more efficient;
- A ban based on emissions standards would be difficult to enforce and labour intensive, requiring technical expertise and testing to differentiate small engine equipment according to actual emissions;
- The extent to which use of two-stroke engine equipment used by public, commercial and institutional operators contributes to poor air quality in the City is not known and there is insufficient data available to estimate this information;
- The City will be in a stronger position to influence the public if it first demonstrates leadership in phasing out less efficient small engine equipment from its own operations before establishing higher standards for the public;
- The preferred approach is to engage in public education and offer incentives as a more effective strategy to encourage phase-out.

As a first step to investigate a regulatory approach, the consultant's report undertook a review of regulations, policies and standards among jurisdictions in Canada, the United States, Europe and Australia. The review determined that municipalities generally regulate two-stroke engine equipment only through noise control by-laws. Toronto has previously considered the regulation of leaf blowers from a noise perspective. Ultimately, Council decided not to restrict the use of leaf blowers in the noise bylaws because of the significant impact this would create on maintaining service levels in City parks and the difficulty of enforcement.

The consultant's review identified changes to U.S. EPA emissions standards for small engine equipment that have occurred since 2001 and looking forward to 2013. In light of the rapid improvements to the standards, an outright ban on two-stroke engines would not have the flexibility required to allow for newer low-emission two-stroke equipment. Based on this review, staff recommend that the phase-out strategy for the broader public

and commercial and institutional operators begin with public education and a buy back incentive program, as outlined below.

This report recommends that the City take the first step and lead by example in phasing out polluting and inefficient small engine equipment. Building on the public education campaign and incentive program discussed below, the City will engage the landscaping industry and other institutions in a consultation process to identify additional options and measures that will accelerate the replacement of polluting small engine equipment, reporting back by the end of 2009.

The Medical Officer of Health and the Executive Director of Municipal Licensing and Standards have been consulted in the preparation of this report and concur with the recommendations.

Public Education Program

This report recommends that the Director of the Toronto Environment Office develop an aggressive public education program in consultation with the Medical Officer of Health. The program would assist residents, businesses and institutions with phasing out polluting less efficient small engine equipment. The educational program would promote and complement the proposed buy back incentive program (discussed below) and would be modelled after the successful pesticide education program led by Toronto Public Health. The intent of the education campaign would be to create widespread awareness of:

- the emissions caused by using older two-stroke engines and the associated climate change and health impacts;
- the importance of regular equipment maintenance and use of premium fuel;
- responsible disposal options for older equipment;
- available technological alternatives including hand-powered equipment;
- landscaping best practices that can reduce or eliminate the need for small engine equipment use; and
- the City's strategy to be a leader in this area and replace polluting less efficient small engine equipment in its operations.

To develop appropriate education materials, staff will engage stakeholders from the public, business and institutional sector. Opportunities for delivering the information include distribution at civic centres and libraries, during Live Green Toronto community events and Councillor's Environment Days, via city newsletters and on City webpages. Staff will ensure that information is provided in multiple languages to ensure it is reaching Toronto's diverse population. Information on the City's phase-out strategy will also be distributed internally so that City employees can be encouraged to take action at home.

Supplementary outreach will also include follow-up meetings with and presentations to equipment retailers, commercial operators and other institutions that use older, less efficient small engine equipment to support them in the development of their own replacement strategies.

Mow Down Pollution Buy-Back Incentive Program

Since 2000, the Clean Air Foundation, in partnership with retailers, manufacturers, recyclers and community groups has operated the national "Mow Down Pollution" program. The program delivers public education on the harmful pollutants released by older gas-powered equipment, assists with disposal of old equipment at free drop-off sites and provides discounts towards the purchase of newer and cleaner equipment. Since 2000, a total of 26,800 gas-powered lawn mowers have been retired across Canada with an estimated reduction in greenhouse gas and smog-forming emissions of 748,000 Kg. The Clean Air Foundation is a not-for-profit organization that develops and manages public engagement programs that help to reduce emissions and improve air quality.

With Council's approval, the City would partner with the Clean Air Foundation to expand on the successful Mow Down Pollution program. The program currently operates over two spring weekends, allowing residents to drop off old equipment at major retail partners for free disposal and a rebate towards the purchase of newer, cleaner equipment.

Funding from the Toronto Environment Office under the LiveGreen Toronto program in the amount of $35,000 will help to expand the program to the Councillor's Environment Days, beginning in September 2009. Funding from the City will support marketing and communications and the management of an equipment drop-off and education centre during the events. Leading up to the drop-off days, the Clean Air Foundation will deliver an aggressive marketing campaign including web, print media, direct mail, social marketing and partnerships with community groups, in addition to the City's regular communication channels such as Councillor newsletters.

The disposal centre would be managed by Clean Air Foundation staff with the assistance of the Toronto Environmental Volunteers, including:

- fully trained, multi-lingual representatives from the Clean Air Foundation to distribute information and facilitate environmentally responsible recycling and disposal of collected equipment;
- volunteers from the City to help distribute information and assist residents;
- a coupon book with rebates towards the purchase of cleaner alternative equipment, funded by participating manufacturers; and
- (pending manufacturer support and involvement) displays of alternative technologies and a product demonstration area.

Following the Fall 2009 Environment Days, staff will review the effectiveness of the program and report back to Council with recommendations to extend the program or if necessary revise the phase-out strategy.

CONCLUSION

The recommendations in this report will contribute to the implementation of the Climate Change, Clean Air and Sustainable Energy Action Plan by greening small engine equipment used in landscaping, tree pruning and public realm maintenance. By transitioning towards greener small engine technologies and changing current business practices, Toronto will demonstrate leadership in this area.

The greening strategy for the general public, commercial operators and other institutions will build on the City's leadership and create an aggressive public education and buyback incentive program for older equipment so that all of Toronto is working together to improve air quality and reduce greenhouse gas emissions.

CONTACTS

Lawson Oates,
Director, Toronto Environment Office,
Tel: 416-392-9744, Fax: 416-338-0808, Email: loates@toronto.ca

Brenda Patterson,
General Manager, Parks, Forestry & Recreation,
Tel: 416-392-8182, Fax: 416-392-8565, Email: bpatter2@toronto.ca

Gary Welsh,
General Manager, Transportation Services,
Tel: 416-392-8431, Fax: 416-392-4455, Email: welsh@toronto.ca

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Richard Butts,
Deputy City Manager

ATTACHMENTS

Appendix 1: Transportation Services and Parks Forestry and Recreation Two Stroke Engine Equipment Inventory

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APPENDIX 1: TRANSPORTATION SERVICES AND PARKS FORESTRY AND RECREATION TWO STROKE ENGINE EQUIPMENT INVENTORY

Equipment	Engine Class	Horse Power	Forestry	Strategic Services	Parks	Trans. Services	TOTAL
Hand Blower	IV	2.7	26		26	9	**61**
Backpack Blower	V	6.7		13	110	9	**132**
Rotary Mower	I	6.7		18	175	15	**208**
String / Line Trimmer	IV	2.0		32	356	43	**431**
Hedge Trimmer	IV	1.3		1	51	6	**58**
Push String Trimmer	IA	1.7				1	**1**
Power Brush / Broom	IV	1.5		2		1	**3**
Power Washer	V	1.6				2	**2**
Rototiller	IA	1.3			3		**3**
Earth Auger	IV	1.3			7	1	**8**
Vibratory plate compactor	I	2.7				2	**2**
Coring Machine	IV	1.7				1	**1**
Jumping Jack Compactor	I	5.5				3	**3**
Chainsaw - Pruning	IV	1.7	154	1	16		**171**
Chainsaw - Limbing	V	3.0	86	3	10	6	**105**
Chainsaw - Felling	V	8.0	57		5	5	**67**
Pole Saw / Pruner	IV	1.9	32			1	**33**
Brushcutter	IA	1.1	9				**9**
Concrete Saw	V	6.7	18		12	17	**47**
Cart Saw	IB	6.7				2	**2**
Stone / Metal Saw	V	6.7			7	1	**8**
Drill	IV	1.3			1	1	**2**
Breaker	I	8.0				8	**8**
Water Pump	IA	1.3				2	**2**
Snow Blower	I	2.0			1	12	**13**
TOTAL			**382**	**70**	**780**	**148**	**1380**

- Class IA: non hand-held, less than 66 cc engine displacement
- Class IB: non hand-held, 66 - 100 cc engine displacement
- Class I: non hand-held, 100 - 225 cc engine displacement,
- Class IV: hand-held, 20 – 50 cc engine displacement,
- Class V: hand-held, greater than 50 cc engine displacement

APPENDIX 2: RECOMMENDED TWO-STROKE ENGINE EQUIPMENT REPLACEMENT SCHEDULE

Equipment	Recommended Technological Alternative	Replacement Schedule				
		2009	2010	2011	2012	2013
Hand Blower	Modern 2-Stroke Engine with Catalytic Converter	12	21	16	12	
Backpack Blower	Modern 2-Stroke Engine with Catalytic Converter	12	33	30	15	42
Rotary Mower	4-Stroke Engine	53*	53	53	49	
String / Line Trimmer	Mixed Fuel 4-Stroke Engine or Modern 2-Stroke Engine with Catalytic Converter	150*	88	75	75	43
Hedge Trimmer	Mixed Fuel 4-Stroke Engine				10	48
Push String Trimmer	4-Stroke Engine		1			
Power Brush / Broom	Mixed Fuel 4-Stroke Engine					3
Power Washer	4-Stroke Engine		2			
Rototiller	Modified 4-Stroke Engine				1	2
Earth Auger	Modern 2-Stroke Engine		2			6
Vibratory plate compactor	Stratified Charge 2-Stroke Engine				2	
Coring Machine	To be determined in 2011			1		
Jumping Jack Compactor	4-Stroke Engine			2	1	
Chainsaw - Pruning	Modern 2-Stroke Engine	62*	35	35	31	8
Chainsaw - Limbing	Modern 2-Stroke Engine		21	27	25	32
Chainsaw - Felling	Modern 2-Stroke Engine with Catalytic Converter		28	20	9	10
Pole Saw / Pruner	Mixed Fuel 4-Stroke Engine				13	20
Brushcutter	Mixed Fuel 4-Stroke Engine				9	
Concrete Saw	Stratified Charge 2-Stroke Engine		11	7	10	19
Cart Saw	Stratified Charge 2-Stroke Engine				2	
Stone / Metal Saw	Stratified Charge 2-Stroke Engine			1	1	6
Drill	Modern 2-Stroke Engine			1		1
Breaker	Pneumatic, Hydraulic or Electrical			2	2	4
Water Pump	Modern 2-Stroke Engine				2	
Snow Blower	4-Stroke Engine				6	7
	TOTAL	**289**	**295**	**270**	**275**	**251**

**This equipment was selected for accelerated replacement because it was found to be most polluting when comparing estimated usage multiplied by the number of units in operation and the relative emission factor.*

APPENDIX 3:
TECHNOLOGICAL ALTERNATIVES TO TWO STROKE ENGINES

Gas powered "two-stroke" engines were invented at the end of the 19th century and are still used in a wide variety of handheld equipment. They operate by completing the power cycle in two strokes of the piston, combining fuel intake and the exhaust of spent fuel during one of the piston strokes. More modern "four-stroke" engines complete the cycle in four strokes of the piston. The two-stroke design allows for a high power output because it generates power from every revolution of the crank instead of from every two revolutions as is the case with a four-stroke engine. This also makes the equipment much lighter than four-stroke engines because the lubricating oil and fuel are mixed and separate storage compartments are therefore not required. The trade-off is that this design significantly increases the emission of pollutants because the combustible mixture is not fully utilized in the process and is purged to the atmosphere as raw or partially combusted products.

Alternative Equipment for use in City Operations

Four-Stroke Engines:
- Clean burning but heavier with a lower power to weight ratio than two-strokes.
- Mechanically more complex requiring more maintenance.
- Require up right orientation to function.
- Burn gasoline only.

Four-Stroke Mixed Fuel Engines
- Four stroke mechanically without separate oil reservoir.
- Will operate in any orientation.
- Requires additional maintenance.
- Requires mixed oil and gasoline fuel.

Modified Four-Stroke Engines
- Compact, medium weight design using pressurized oil in mist form for lubrication.
- Can by used in any orientation.
- Burn gasoline only.
- Requires additional maintenance.
- Not suitable for high revolution applications such as chain saws

- **Modern Two-Stroke Engines**
- Highest power to weight ratio.
- The only design compatible with high revolution applications.
- Modern design has produced greater efficiency and lowered emissions.
- Burn oil and gasoline mixture.
- Can be used in any orientation.

Stratified Charge Two-Stroke Engines

- Two stroke design using a sub chamber to inject pressurized fuel into a combination of fresh air and un-combusted exhaust gas as it enters the cylinder.
- Can be used in any orientation
- Increased weight and size limit this design to larger applications.

Catalytic Converters

- Generally replace existing exhaust components.
- Aftermarket units may void original manufacturer warranties.
- Cost proportional to rare metals market.
- The catalyst (typically platinum) breaks down NOx gas into oxygen and nitrogen and combusts unburned hydrocarbons and carbon monoxide rendering them inert.
- Most manufacturers are working to make these units standard on new designs.

Additional Alternatives for the General Public

Manual Tools

- Emission-free and human powered.
- Includes anything from rakes to hand clippers, pruning shears, shovels, spades, push mowers, hoes and hand brooms.
- Many of these tools are in regular use already by city staff (i.e. weeding of horticultural beds and maintenance of small or hard to reach areas).
- Wider use of manual equipment in City operations is being explored but is limited by ergonomic concerns when using the equipment for a full day.
- For home use, manual equipment is highly encouraged.

Solar Powered Equipment

- Emission-free and runs on renewable energy.
- A number of retailers now sell lawn mowers, trimmers and other home garden equipment that runs on solar charged batteries.
- Considered for use by City staff but reliability was a concern. City equipment is required to operate for the full day (i.e. 8 hours) with little or no opportunity for recharging batteries. Further, the equipment generally has lower torque than gas-powered equipment making it unable to meet the City's service imperatives.
- None of these limitations would apply to home use and this green alternative is highly encouraged.

Electrical Equipment

- When combined with green electricity purchase, this equipment can be emission-free and is significantly quieter than gas-powered small engine equipment.
- Not considered for use by City staff because of on site safety concerns with cords in City Parks and the limited availability of electrical outlets in City parks and road allowances.
- Appropriate for home use by the general public since plugs are readily available and the hazards are manageable. This alternative is encouraged particularly when a home is powered by renewable energy.

APPENDIX 4: ESTIMATED EMISSIONS REDUCTIONS FROM THE ACCELERATED CITY EQUIPMENT REPLACEMENT STRATEGY

Chart 1: Annual Emission Reductions of CO_2 through Equipment Replacement (Kg)

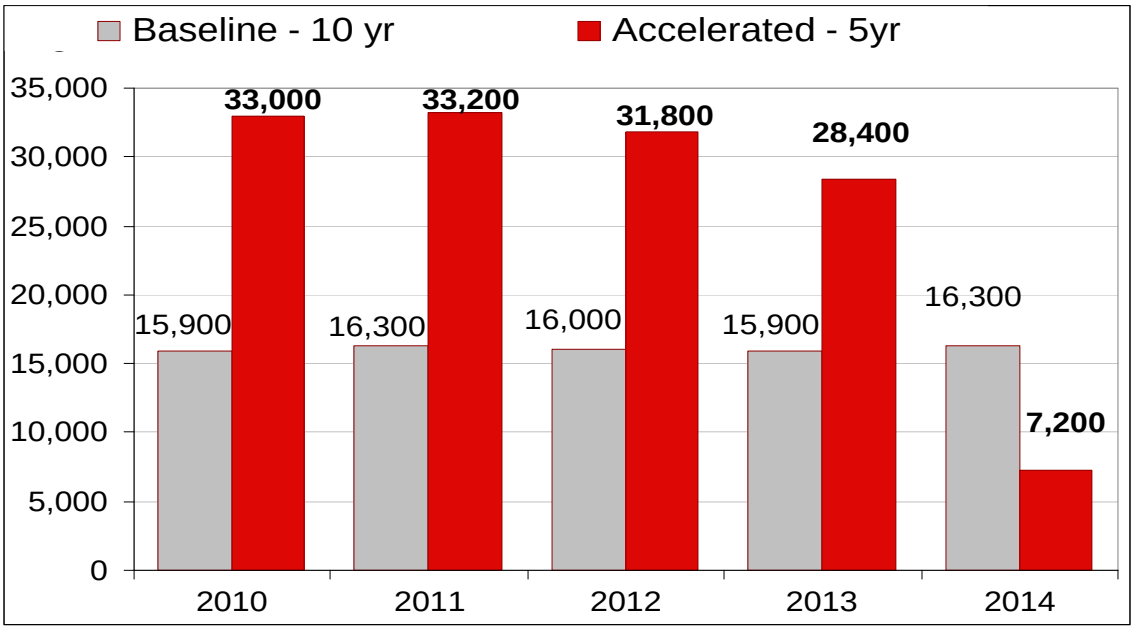

Chart 2: Cumulative Emission Reductions of CO_2 (Kg)

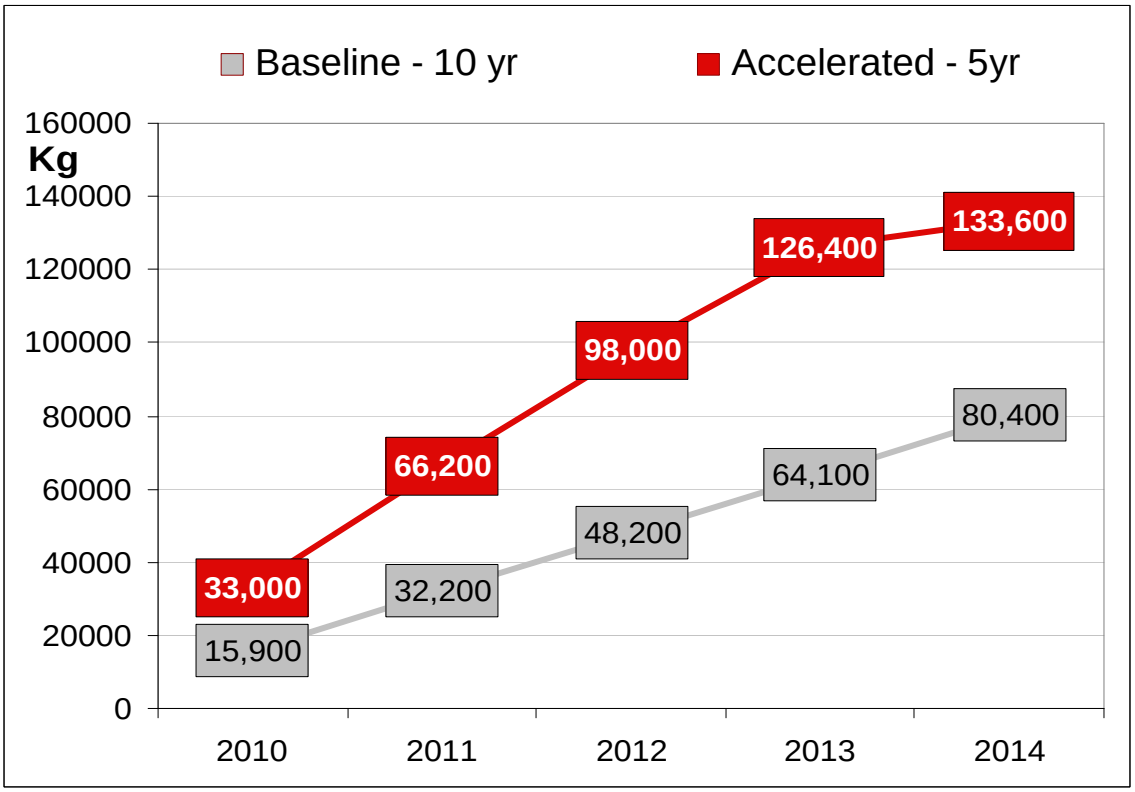

Chart 3: Annual Emission Reductions of HC + NOx through Equipment Replacement (Kg)

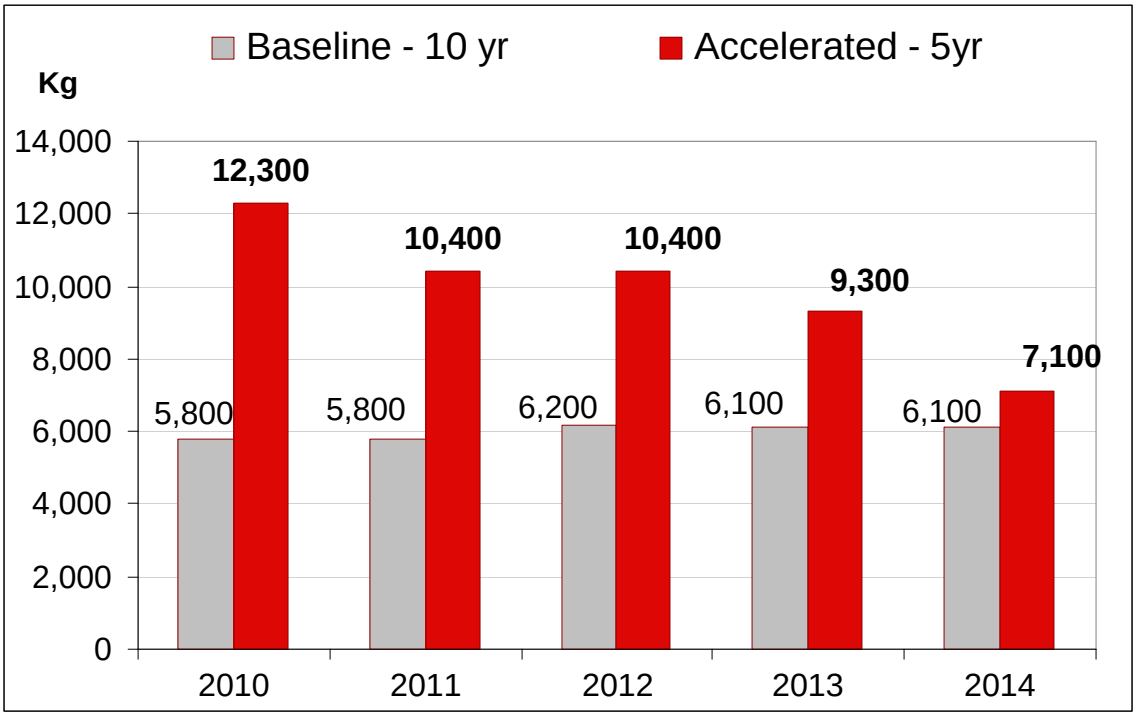

Chart 4: Cumulative Emission Reductions of HC + NOx (Kg)