HALIFAX
REGIONAL MUNICIPALITY

P.O. Box 1749
Halifax, Nova Scotia
B3J 3A5 Canada

Item No. 6
Halifax Regional Council
June 7, 2011

TO: Mayor Kelly and Members of Halifax Regional Council

Original Signed

SUBMITTED BY: Councillor Peter Lund, Chair, Environment and Sustainability Standing Committee

DATE: May 18, 2011

SUBJECT: **Community Garden Heavy Metal Study**

INFORMATION REPORT

ORIGIN

Motion of the Environment and Sustainability Standing Committee May 5, 2011 meeting:

MOVED by Councillor Watts, seconded by Councillor Sloane, that the Environment and Sustainability Standing Committee:

1. **Accept the Community Garden Heavy Metal Study Report as outlined in Attachment One of the staff report dated April 7, 2011;**
2. **Direct the following policy to staff:**
   That Community Gardens growing vegetables on municipal property either:
   a. Test the soil for heavy metals, organic matter and acidity; or
   b. Install a raised bed with imported clean soil; and
3. **Forward a copy of the April 7, 2011 staff report to the Chief Medical Officer for the Capital District and ask for a written response based on the findings of this study; and**
4. **Forward the April 7th staff report to Regional Council as an information report.**

MOTION PUT AND PASSED.

BACKGROUND

The Environment and Sustainability Standing Committee received a staff report and discussed the Community Garden Heavy Metal Study respecting community gardens growing vegetables on municipal property.

Additional information can be reviewed within the attached staff report dated April 7, 2011.

DISCUSSION

The Environment and Sustainable Standing Committee discussed this matter during their May 5, 2011 meeting.

Councillor Watts suggested that it would be helpful for the Chief Medical Officer to provide comment to the Standing Committee on her interpretation of the Community Garden Heavy Metal Study Report.

Councillor Sloane suggested that straw bales be used to make the raised beds instead of wood.

BUDGET IMPLICATIONS

There are no impacts on the HRM Capital or Operating Budget from this report. HRM contributed $10,000 towards the study in fiscal year 2010-2011, funded from D948 Sustainable Community Projects.

FINANCIAL MANAGEMENT POLICIES/BUSINESS PLAN

This report complies with the Municipality's Multi-Year Financial Strategy, the approved Operating, Project and Reserve budgets, policies and procedures regarding withdrawals from the utilization of Project and Operating reserves, as well as any relevant legislation.

COMMUNITY ENGAGEMENT

The Environment and Sustainability Standing Committee meetings are open to members of the public.

ATTACHMENTS

Staff Report dated April 7, 2011.

A copy of this report can be obtained online at http://www.halifax.ca/council/agendasc/cagenda.html then choose the appropriate meeting date, or by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

Report Prepared by: Krista Tidgwell, Legislative Assistant, Municipal Clerks Office, 490-6519

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P.O. Box 1749
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Environment and Sustainability Committee
May 5, 2011

TO: Chair and Members of Environment and Sustainability Committee

SUBMITTED BY: Original Signed
Phillip Townsend, Director, Infrastructure and Asset Management

DATE: April 7, 2011

SUBJECT: **Community Garden Heavy Metal Study**

ORIGIN

Item 8.1 Regional Council, April 27, 2010: Community Gardening

RECOMMENDATION

It is recommended that the Environment and Sustainability Committee:
1. Accept the Report in Attachment One;
2. Recommend the following policy to Regional Council:
   That Community Gardens growing vegetables on municipal property either:
   a. Test the soil for heavy metals, organic matter and acidity; or
   b. Install a raised bed with imported clean soil; and
3. Forward a copy of this report for information to the Chief Medical Officer for the Capital District.

BACKGROUND

During the past couple of years, the municipality has been supporting growing community interest in Community Gardening.

This has included a toolkit on myHrm.ca on Community gardening:
http://www.myhrm.ca/ToolKit/CommunityGardens.php

DISCUSSION

During community engagement on helping enhanced participation in 2010, concerns were raised about the health impacts of urban vegetable and garden growing related to heavy metals in urban soils. As such, The Nova Scotia Agricultural College, Halifax Regional Municipality (HRM), Ecology Action Centre, Nova Scotia Environmental Network, and Environment Canada collaborated on a study to investigate the concerns.

The attached report (attachment one), press release (attachment two), and HRM test results (attachment three), outline the findings.

There are indeed heavy metals present and reasonable precautions include testing soils or making raised beds for gardening, particularly for vegetable gardening.

BUDGET IMPLICATIONS

There are no impacts on the HRM Capital or Operating Budget from this report. HRM contributed $10,000 towards the study in fiscal year 2010/2011, funded from D948 Sustainable Community Projects.

FINANCIAL MANAGEMENT POLICIES / BUSINESS PLAN

This report complies with the Municipality's Multi-Year Financial Strategy, the approved Operating, Project and Reserve budgets, policies and procedures regarding withdrawals from the utilization of Project and Operating reserves, as well as any relevant legislation.

COMMUNITY ENGAGEMENT

This is a community collaboration.

ALTERNATIVES

None recommended

ATTACHMENTS

Attachment One:	Chapter 5/Conclusion and Recommendation of the Community Garden Heavy Metal Study Report (Full report can be found on the SEMO page http://www.halifax.ca/environment/semo.html#Cleanland. direct link on the Ecology Action Centre's web site).
Attachment Two:	Press Release
Attachment Three:	HRM Results

A copy of this report can be obtained online at http://www.halifax.ca/commcoun/cc.html then choose the appropriate Community Council and meeting date, or by contacting the Office of the Municipal Clerk at 490-4210, or Fax 490-4208.

Report Prepared by: Richard MacLellan, Manager, Sustainable Environment Management Office, 490-6056

Chapter 5: Conclusion and Recommendation

The concentration of lead, arsenic, copper and zinc was measured in samples collected from current and potential gardens in the HRM. Within each site, random samples were collected to obtain a representative estimation of heavy metal contamination in each garden. Partial digestion of soil samples was carried out to estimate the bioavailable concentration of heavy metals. Soil heavy metal concentrations were compared to the CCME soil quality guidelines for agricultural lands in order to assess the level of contamination and potential risk to human and ecological health. The results of this study indicate that more than one third of samples had higher concentration of lead than the CCME guideline. Arsenic contamination was also seen widely in the sampled sites, with a concentration higher than the CCME guideline in almost half of the sampled locations. This was expected due to the high background concentration of arsenic in Nova Scotia soils and bedrock. Copper and zinc were also measured for this study and only a few sampled locations had higher concentration of these elements than the CCME guideline. However, the concentration of zinc and copper might have been underestimated due to the selection of the digestion method.

Following the correlation analysis, it was concluded that the occurrence of lead, zinc, and copper are related. There were no obvious patterns for spatial distribution of these heavy metals in the HRM. By comparing the results of this study with similar studies conducted in other Canadian cities, it was concluded that the lead concentration in the HRM was lower than Sydney, NS, Trail, BC, and St. John's, NL, and higher than Sudbury, Ottawa, and Iqaluit. It is important to keep in mind that concentrations of heavy metals between cities might not be directly comparable, as some studies use different sampling strategies and analytical methods.

Overall, raised-bed gardens had lower concentration of heavy metals; however, maintaining raised beds to prevent migration of contamination from adjacent lands is crucial. In order to reduce the influence of wind-transported contamination, it is

recommended to remove the 3 – 5 cm of soil and replace it with compost each year (Clark et al., 2008). Various other studies have investigated phytoremediation of contaminated gardens. Further research is required to study the feasibility of phytoremediation for HRM gardens, but Clark et al. (2008) concluded that unamended phytoremediation is not a viable technique for urban communities. The soil intervention also studied, and the high cost of process, makes it an impractical option for soil remediation. Clark et al. (2008) concluded that raised beds are the best option for growing food in contaminated lands as they allow gardeners to continue growing produce without replacing all the garden soil. They also reported that the remediation on a yard-by- yard scale is not effective in an urban community with regional lead contamination as a result of recontamination from wind-transported fine grain soil from adjacent contaminated lands.

Roots tend to accumulate heavy metals from the soil more than other tissues of the plant. However, direct ingestion of contaminated soil (adhering to roots) is considered the major exposure pathway of these heavy metals (Clark et al., 2008). Peeling root vegetables such as potatoes and carrots as well as washing or disposing old leaves, is recommended. Washing hands carefully after gardening is also very important. Vegetables such as spinach, cabbage, mustard, sunflower, and lettuce showed higher accumulation of heavy metals especially in their roots and older leaves.

It is important to mention that the consumption of produce from contaminated gardens contributes a small percentage of daily lead exposure. For example, in a study conducted by Clark et al. (2008), in Boston communities of Roxbury and Dorchester, MA, only 2-3% of daily lead exposure takes place through consumption of produce, while ingestion of soil contributes to 72-91% of the daily lead intake. They concluded the other sources of lead exposure to be inhalation of ambient air (2-5%) and consumption of tap water (1-5%).

This is a preliminary study providing an indication of four heavy-metal contaminations in the sampled gardens. More elements and sampling locations should be considered for the

next step of this study. By performing isotopic analysis, the source of heavy-metal contamination in the soil can be identified and remediation options for contaminated soil, specifically for the HRM, can be studied. The heavy-metal contamination of indoor dust and its relation with garden and neighborhood contamination can also be investigated.

Ecology Action Centre strongly supports organic urban gardening. For new gardens, testing the local soil for heavy metals and comparing the results with the CCME guidelines is suggested. Raised-bed gardens with clean and high quality soil are highly recommended, especially within the peninsula. Special attention should be given in selection of the wood and soil of raised beds since they can potentially contain high level of toxic materials. Lining the new gardens with appropriate barriers will further reduce the migration of heavy metals from existing soil to the garden soil.

Ingestion of soil is the most important pathway of heavy metals into a human body; it is important to clean hands after gardening and wash produce carefully. Since heavy metals tend to accumulate in roots, peeling root vegetables before eating them is a good habit to reduce the daily intake of heavy metals.

April 4, 2011
For immediate release

Community Garden Heavy Metal Study – Recommendations for Spring Gardeners

NSAC, Truro, NS — April 4, 2011 — Nova Scotia Agricultural College (NSAC) and the Ecology Action Centre (EAC) have released the results of a study looking at Heavy Metals in city garden sites in Halifax Regional Municipality (HRM). The study, funded by Environment Canada, HRM and NSAC, involved the sampling and analysis of soils collected from 26 community and private gardens, as well as 18 municipal public parks and lands across the HRM.

"We know that many urban areas in North America have been contaminated by past industrial practices such as the burning of fossil fuels to generate electricity and to heat homes, and the use of leaded gasoline," explains Sadra Monfared, an engineer and the principal author of the report. "These metals can also occur naturally in soils, depending on the bedrock from which they are derived," he added.

The question of soil health is an important one in the burgeoning urban gardening movement. The heavy metal study was to determine if soils in HRM were contaminated with lead, arsenic, copper, or zinc and to begin formulating recommendations for urban gardeners whose soils could be contaminated.

The study compared heavy metal concentrations found in the HRM soils to standards published by the Council of Canadian Ministers of the Environment (CCME). For soils used for agricultural purposes, the CCME limits for the concentration of lead and arsenic are 70 and 12 µg/kg (micro-grams per kilogram) respectively. Lead concentrations in the NSAC/EAC study ranged from 10 to 767 µg/kg, with an average lead value for all soils of 109 µg/kg. Approximately 40 per cent of the study soils exceeded the CCME guideline. Similarly, concentrations of arsenic in the soils ranged from 4 to 153 µg/kg, and approximately 50 per cent of the soils exceeded the CCME guideline. In the case of both lead and arsenic, most of the samples taken from the Halifax peninsula, where industrial activity has been going on for over 250 years, exceeded the concentration considered safe for agricultural use. At high enough concentrations, lead, arsenic and copper can be harmful to human and ecosystem health.

"Although there is a clear indication of elevated metals in these soils, we are still looking into what extent eating vegetables grown on affected soil is a hazard to human health," commented Dr. Richard Donald a soil scientist at NSAC, and the technical advisor to the project.

The risk to gardeners is in ingesting lead from contaminated soils either through inhaling dust in the garden or from dirt on their hands travelling to their mouths. This is the most likely means of contamination rather than through eating vegetables grown in the soil.

"Based on past studies, and from consultation with health risk experts, we believe the risk to urban gardeners and to people who eat the vegetables grown on these gardens is low," adds

Dr. Donald. The authors of the report urge HRM gardeners, particularly those on the peninsula, to take steps to limit their exposure to heavy metals and the report offers several recommendations to mitigate these risks:

- Have your soil tested for heavy metals, organic matter, and acidity. This will help you decide what other precautions are needed, if any.
- Wash your hands well after gardening, or use gloves; rinse garden produce prior to eating; wash and peel root vegetables like potatoes and carrots and avoid weeding or digging dry dusty soil.
- Adding organic matter and lime to your soil will help to limit the uptake of metals by your body or by plants grown in the soil.
- If your site is highly contaminated, build raised-beds and import clean soil to isolate your garden from the contaminated area, or choose to garden elsewhere, such as your neighborhood community garden.

"It is not surprising, that in one of the oldest industrialized cities in North America, you would find contaminated soils," says Garity Chapman of the Urban Garden Project of the Ecology Action Centre and an advisor to the study team. "We would like to encourage the growth of urban gardens as a way to promote food self-reliance and improve access to whole, nutritious foods. This is a community wide issue, affecting not only gardens but our green spaces in general. We need to care for our soil and do what we can to foster health and wellness in our cities," she added.

The authors of the study feel it is timely, as many prepare for the summer gardening season that these concerns are made public. The Urban Garden Project will continue to look at this issue and offer support to the public as they build and work in their community gardens.

The complete study may be downloaded from the Ecology Action Centre's website (http://www.ecologyaction.ca/content/urban-garden-project).

For further information or comment contact:

Carey Jernigan, Ecology Action Centre (urbangarden@ecologyaction.ca, (902-442-0202)
Dr. Richard Donald, Nova Scotia Agricultural College (rdonald@nsac.ca), (902-956-4925)

Dear Richard MacLellan,

Thank you for participating in the "Community Garden Heavy Metal Study."

Our research is done and we're excited to start preparing our gardens for the spring. Please find information about the study and your results below.

Some Background:

Both at the Ecology Action Centre (EAC) and the Nova Scotia Agricultural College (NSAC), we celebrate the joy and importance of growing food in the city. Like many of you, we spent the summer and fall eating tomatoes, greens, and garlic out of our garden and sharing in the work of others across the Halifax Regional Municipality. As part of that process, we started to ask questions about the quality of urban soils. And in response to yours and other gardeners' concerns, we tested several sites for heavy metal contamination.

Because of industrial practices over the years, natural soil chemistry, motor vehicle emissions, and lead and zinc in old house paint, for example, some of the soil we tested was contaminated. Thankfully, there are several ways that gardeners can mitigate the potential human health risks of heavy metals in soil. And because contamination occurs in cities worldwide, we are now part of an important effort to identify and develop safe gardening practices for urban environments.

Your Results:

Samples collected at specific locations from several city gardens, and they were carefully handled and analyzed in the NSAC chemistry laboratory. pH (a measure of acidity), organic matter content and the concentrations of lead, arsenic, copper and zinc were measured.

Listed below, you'll find the CCME (Canadian Council of Ministers of the Environment) soil quality guideline for agricultural land:

	Arsenic	Copper	Lead	Zinc
Maximum acceptable concentration for agricultural lands – ppm	12	63	70	200

In the following table you'll find the average concentration of heavy metals in these sites as well as pH and the organic matter content of the sampled soil.

			Mean concentrations of heavy metals in the garden soil – ppm			
Site name	pH	OM	Arsenic	Copper	Lead	Zinc
Conrose Park	6.32	6.76	8	16	23	64
Victoria park	5.37	5.33	20	20	56	51
Ravenscraig – 1	5.51	7.45	151	33	151	80
Ravenscraig – 2	6.19	1.62	7	14	21	43
Ravenscraig – 3	5.93	4.46	13	12	61	63
Hemlock Ravine Park – 1	5.5	5.05	8	15	18	62
Hemlock Ravine Park – 2	4.07	16.14	5	14	42	54
Lion's Park	5.53	4.3	10	16	31	74
Halifax Commons – 1	5.16	7.67	153	79	585	219
Halifax Commons – 2	5.41	6.7	53	68	437	204
Halifax Commons – 3	5.4	5.53	13	24	106	151
Ardmore Park	5.4	3.85	8	15	25	103
Mayor's Garden	6.15	3.47	7	18	51	119
Halifax Mainland Common	6.43	2.98	8	16	17	45
Robie St. Median	5.95	3.93	39	36	181	100
North St. Median	6.05	5.01	17	35	160	107
University Ave. Median	5.49	4.00	15	25	98	87

pH measures if your soil is acidic, alkaline or neutral, indicated by numbers from 0-14 with 0 being extremely acidic and 14 being extremely alkaline ("basic"). Most plants prefer a neutral soil, somewhere in the range of 6 – 7.

Organic matter refers to the plant and animal materials that exist in the soil. It is important to be constantly adding organic matter to improve soil structure and replace micronutrients that plants need to thrive. According to Nova Scotia Department of Agriculture, a good organic matter concentration is greater than 3.5%.

Gardening in Contaminated Sites:

For those whose results show some level contamination, don't despair! We're in the process of researching remediation (practices that improve your soil) and ways to mitigate the human health risks, if any, of heavy metal contamination. We reached out to professionals and urban farmers across Canada and the United States to ask their opinion, and together came up with the following recommendations:

- If you can afford it (or apply for a small grant), have your soil tested for heavy metals and compare the results with the CCME guidelines. We found that lead, zinc, copper, and arsenic are the most important metals to test for. We are looking into local labs to find the best deal for gardeners who want to test for heavy metals going forward.
- If you're not sure, or you know that your site *is* contaminated, you can build raised beds and bring in clean soil from elsewhere. There are lots of ways to do this: building a box at least 6 inches high out of scrap wood or stone tiles and laying a sheet of landscaping cloth along the bottom. Food-safe plastic buckets salvaged from grocery stores also make great container gardens. The Urban Garden Project has a list of soil suppliers in HRM.
- If you'd rather work with the soil that already exists on your site, there are lots of ways to reduce possible health risks.

- "Eating dirt" is by far the most significant way that heavy metals enter the human body. Wear gloves if possible, especially if you're gardening with children. Clean your hands afterwards and wash produce carefully.
- Avoid weeding on very dry days, or use the "chop-and-drop" method where you cut young weeds just above the soil and let the greenery fall to the ground as mulch.
- Since a little soil sticks to roots, peeling root vegetables and growing lots of leafy greens and fruits is a good approach.
- Last but not least, adding organic matter to your soil reduces the amount of contamination that is taken up by your body and dilutes what exists in the soil. Similarly, adding wood ash, lime, or egg shells to make the soil less acidic reduces heavy metal absorption in humans. These things also help your Nova Scotian garden grow!
- The Nova Scotia Soil testing Lab, located at the Nova Scotia Agricultural College, will test your soil for organic matter, acidity and other essential nutrients (but not heavy metals) and provide recommendations regarding the amount of lime you should add to reach a soil pH of 6.5. For more information, visit http://www.gov.ns.ca/agri/qe/labserv/soilsamp.shtml.

Thank you to Sadra Monfared for carrying out this study; to the EAC, the NSAC, the Halifax Regional Municipality (HRM), and the Nova Scotia Environmental Network (NSEN) for forming our steering committee; and to Environment Canada, NSAC and HRM for funding Sadra's position.

Please be in touch if you have any questions about your results.

We appreciate your participation in this project!

Thank you,

Sadra Monfared & Carey Jernigan (Urban Garden Project, EAC)

Dr. Richard Donald (NSAC)

Contact:

Carey Jernigan, UGP Outreach Coordinator, Ecology Action Centre

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