August 22, 2005

Workplace Health and Public Safety Programme
Ontario and Nunavut Region
55 St. Clair Avenue East, Room 315
TORONTO, Ontario, M4T 1M2

Sgt. Bob Penney
Royal Canadian Mounted Police
345 Harry Walker Parkway South
NEWMARKET, Ontario, L3Y 8P6

**RE: Indoor Environment Investigation**

Please find enclosed the findings and recommendations from the above investigation carried out by our Programme's Safety Engineer at the RCMP Newmarket operations that was undertaken July 27 2005.

The report takes into account occupant complaints of composting odours (from sporadic episodes) and explores remedial measures in efforts to reduce the impact of composting odours on RCMP operations. It is appreciated that certain solutions could involve many stakeholders; the Municipality of York Region, the Ontario Ministry of Environment, the Composting Plant, adjoining property owners etc.

Environmental complaints of odour emissions from the nearby composting plant be reported to the appropriate authority - Ontario Ministry of Environment and Energy. If there is a community health concern, please contact the local health authority - the Medical Officer of Health for the York Regional Health Department.

If you require further information pertaining to this report, please contact me at (416) 973-7829. The Public Works and Government Services Canada (PWGSC) officials dealing with this issue (with your Facility Management) should be made privy of this report given that PWGSC has examined engineering solutions.

Respectfully,

Peter Choremiotis, MSc, BASc, CRSP, CPHI(C)
Environmental Health Officer

Encl. Final Report

c.c. Lillian Urquhart, Health Canada
Bruce Kemball, Royal Canadian Mounted Police
Joe Skakavac, Royal Candian Mounted Police
Paul Pyke, Royal Canadian Mounted Police

**Indoor Environment Investigation**

**By**

**Health Canada**

**Workplace Health and Public Safety Programme**

**Ontario and Nunavut Region**

**55 St. Clair Avenue East**

**Toronto, Ontario**

**For**

**Royal Canadian Mounted Police**

**345 Harry Walker Parkway South**

**Newmarket, Ontario**

**August 2005**

Date: 2005 08 19

To: Peter Choremiotis, Environmental Health Officer
Health Canada WHPSP,Ontario and Nunavut Region

From: Immo Tilgner, Safety Engineer
Health Canada WHPSP, WSU

Location: Royal Canadian Mounted Police

345 Harry Walker Parkway South

Newmarket, Ontario

Subject: Nuisance Odour – RCMP Building

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## Executive Summary

The Royal Canadian Mounted Police (RCMP) site is situated at 345 Harry Walker Parkway South in Newmarket Ontario. The RCMP site contains a secure parking lot, an office building housing approximately 350 employees, and a shop building for technical services housing about 12 people. The RCMP is located north of the property line of the adjacent composting plant owned and operated by Halton Recycling Ltd. The complaint is process odour from the composting plant which sporadically affects air quality on the entire RCMP site, both outdoors, and indoors.

The composting plant serves the town of Newmarket and surrounding area. It takes delivery of kitchen and yard waste and processes the waste into compost and electric energy. The waste originates from the extended community around the plant and at one time included farm waste and industrial food processing waste. The composting process generates a strong odour at ground level that cannot be contained, or diluted to reduce impact on adjoining properties. The effect on outdoor air quality on surrounding properties is a marked "signature odour" of the composting process. This includes all manner of decaying matter. There is no way at present to avoid the odour at the RCMP establishment when the wind blows from the south.

The report takes into account occupant complaints of composting odours (from sporadic episodes) and explores remedial measures in efforts to reduce the impact of composting odours on RCMP operations. It is appreciated that certain solutions could involve many stakeholders; the Municipality of York Region, the Ontario Ministry of Environment, the Composting Plant, adjoining property owners etc.

**Background**

A request was received by Peter Choremiotis, Health Canada WHPSP EHO to investigate indoor and environmental problems in the RCMP Buildings which are located in Newmarket, Ontario. Peter Choremiotis initiated indoor air sampling on the RCMP site to establish if toxic or harmful organisms may be present in indoor air. No health hazards were identified. However, it was noted that the comfort issue needs to be addressed.

Peter Choremiotis then went together with Immo Tilgner, Safety Engineer of WHPSP, on site on Wednesday, 27 July 2005 to inspect this location to explore engineering options to deal with the prevailing odour. The point of the investigation was to look for any unusual building operating difficulties in relation to their setting, and in context of the local outdoor environment, and to explore options towards elimination of odours at the RCMP site, and in properties surrounding the composting plant.

Individuals that participated in the investigation:

Peter Choremiotis Environmental Health Officer (EHO) 613 973-7829
Health Canada Workplace Health and Public Safety Programme (WHPSP)

Immo Tilgner Safety Engineer 613 957-8458
Health Canada Workplace Surveillance Unit (WSU)

Paul Pyke Facility Manager, Royal Canadian Mounted Police
345 Harry Walker Parkway South, Newmarket, Ontario 905 953-7696

Bill Palmer Operations Manager, Halton Recycling Ltd
395 Harry Walker Parkway South, Newmarket, Ontario 905 868-8224 308

Noel Moya General Manager, P Eng., Halton Recycling Ltd
395 Harry Walker Parkway South, Newmarket, Ontario 905 868-8224 301

## Codes and Standards

Recommendations made for the RCMP in this report are based on the Canada Labour Code Part II, Occupational Safety and Health Regulations, and the Treasury Board Guideline regarding Occupational Safety and Health. Requirements listed pertain to the needs of Safety and Health. Requirements unrelated to Safety and Health are not considered appropriate and are kept to a minimum.

Recommended action should be reviewed by the local Joint Occupational Safety and Health (JOSH) Committee with the intent to explore other possible options to correct identified operating difficulties. Options other than the recommended actions may be exercised provided the intent of the applicable Code and/or Standard is being met.

Due to major impact on the RCMP site environment by the adjoining property, it is essential to maintain the established communication link, and to take part in the Joint Complaint Resolution Process that has been initiated already.

For the RCMP (Federal) Building, the following Code and Standard references would apply:

Canada Labour Code Part II, January 2003, Regulations Respecting Occupational Safety and Health

Part II, Permanent Structures,
Division I, Buildings, and
Division II, Towers, Antennas and Antenna-Supporting Structures, and
Division III, HVAC Systems

National Building Code 1995, Part 6, Heating, Ventilating and Air-Conditioning

Section 6.2, Design and Installation,
Item 6.2.1.1, Good Engineering Practice, listing applicable Standards and Guidelines.

Section 6.2.2, Ventilation, and specifically
Item 6.2.3.12, Make-up Air, and
Item 6.2.3.13, Supply, Return, Intake and Exhaust Air Openings, and
Item 6.2.3.14, Filters and Odour Removal Equipment, and
Item 6.2.3.15, Air Washers and Evaporative Sections or towers, and
Item 6.2.3.16, Fans and Associated Air Handling Equipment

Section 6.3, Chimneys and Venting Equipment-quoted Standard is NFPA 211; for this application see NFPA 211, Chapter 5, Unlisted Metal Chimneys for Guidance on Structural Requirements of Stacks

Section 6.3.1.4, Lightning Protection Systems-quoted Standard is CAN/CSA-B72-M-Installation Code for Lightning Protection Systems

**Investigation**

Plant management needs to know how well the plant performs with respect to odour control. This is gauged by using statistical analysis of Odour Units (OU) established at the plant property line. Feedback from adjoining properties is essential in tracking the OU and keeping OU at or below acceptable limits.

It should be noted here that the first part of the investigation was carried out by Peter Choremiotis , EHO from the Toronto office of Health Canada WHPSP. The report has been issued in July 2005. Findings from the investigation indicated that no occupational health hazard has been identified at the RCMP building.

This next part of the investigation involved the type and severity of the odour to assess annoyance and comfort issues associated with the odour imposed on staff working at the RCMP building. This included the local setting of the source and the affected parties. Finally there was the Safety and Health aspect of how to minimize exposure, be it administrative control, engineering control, or personal protective equipment that may be issued by the employer.

Indoor air was tested previously by the Environmental Health Officer and was found to be non hazardous to certain parameters. However, the plant does create a nuisance odour that cannot be stopped at the property line when it does occur.

Corrective action can be achieved by ongoing feedback to the composting plant manager. To some extent this has been done through meetings and e-mail messaging to identify when the composting process is flawed, or when unacceptable materials are being incorporated into the composting process.

Note that staff at the composting plant may not perceive strong odours as they have been acclimatized to their work situation. The plant workers may not notice a bad odour, so the feedback to them is essential to have them take corrective action. Also note, when conditions at the RCMP site are at their worst, conditions at the plant are much better, as the plant is located upwind during a south wind, in a clean breeze, and the RCMP site is downwind of the plant, and all plant activity. So the strong odour received at the RCMP site is not necessarily perceived as such at the plant site.

## Facts, Events, and Recommendations

### RCMP Office, Buildings, and Site

The odour problem affects the indoor air quality, but it also affects the RCMP site. Improvement to the indoor air quality may be attained through engineered solutions at the outside air intake, but improvement of the air around the RCMP building can only be had with improved composting plant management.

The RCMP office building is located north of the composting plant. The building is four (4) storeys tall with a set back penthouse on the roof that houses the Heating, Ventilation and Air Conditioning (HVAC) equipment. The outside air intakes serving the HVAC systems are located at roof level and face south towards the composting plant.

A quick air flow analysis indicated that it did not matter if the air intakes on the roof faced north or south. Due to aerodynamic behaviour of air flowing over and around the building, odour would be drawn into the building as long as the wind was blowing from the composting plant towards the building. Odour is trapped within the building's air boundary layer, and clean air cannot be had anywhere within that layer of air.

Odour originating at the composting plant are generated at ground level. Much of the odour is generated as bulk shipments of waste, and harvested compost are being transferred between vehicles and buildings. Specific strong odour is also generated when the composting plant requires maintenance on biofilters and digesters. These events can stretch into weeks of bad odour imposed on neighbouring properties.

As odour drifts at fairly low level on the upwind side towards the RCMP building, it encounters the vertical building facade. The odour tends to rise up the facade and then rolls over the parapet forming the edge of the roof. It then encounters the penthouse (and the outside air intakes) and drifts over the penthouse obstruction as well. On the lee side the reverse takes place, and the odour settles at the building main entrance in a large horizontal vortex that spills to the two sides of the building. One end of the vortex discharges to the secure parking area, the other discharges towards the RCMP Shop building, where the odour is also drawn into that building air intake. The odour also drifts around the east and west side of the RCMP building, where additional outside air intakes are located at grade level.

For both the RCMP buildings the only source of clean air may be high above the building. It would be important to reach well beyond the buildings' air boundary layers to tap into the potentially cleaner air well above the building.. Suitable outside air may be found above the cavity zone, wind eddy zone and wake zone of the building. For an outline of the theory see **2004 ASHRAE Handbook - HVAC Systems and Equipment, Chapter 30, Chimney, Gas Vent, and Fireplace Systems**. The air boundary layers are located directly above and generally downwind of the leading edge of the buildings. The objective is to tap into free flowing relatively clean air that has not been polluted by the composting plant close to the south edge, but well above the roof edge of the building. Fixed tall air intake stacks would have to be mounted on the existing roof (south side) to reach beyond the boundary layer.

It should be noted that the stacks will act as chimneys with associated draft, which needs to be overcome to achieve air flow into these stacks. This implies that the installation may also have to incorporate roof mounted booster fans to overcome air friction loss and stack effect of the building. The building should continue to be operated in positive pressure mode (with respect to atmosphere) as it is operated now, to keep odour infiltration at bay.

A single stack may not be acceptable with respect to architectural expression. Multiple stacks are options that may need to be explored with the architect, engineer and the zoning authorities. The stacks would also require protection from wind induced oscillation, wind drag, precipitation, birds, and lightning. The stacks may have to be 14 metres high (about 40 feet).

The functional height of the stacks on top of the buildings would have to be determined through wind tunnel test and analysis which would have to include the RCMP building, the intervening terrain and ground cover, and the composting plant modelling. Note that only south wind direction is at issue with respect to odour, which would reduce cost. But wind induced stack oscillation may be at its highest with east and west winds, so these tests would also be necessary.

Existing antenna towers may have to be raised or relocated as well, to clear the air intake stacks.

**Recommendations:**

**Recommendations made in this report are intended to examine possible solutions and are provided for this purpose. These recommendations should be brought to the consideration of PWGSC as they are working with RCMP Facilities Management in seeking engineering controls to remedy problem. The guidance offered by PWGSC to RCMP Facilities Management is important and Health Canada views PWGSC as the lead advisor to RCMP as for implementing engineering controls to building and property and is supportive of PWGSC efforts.**

**For the RCMP Office Building:**

Explore the use of vertical stacks to reach uncontaminated air layers above the building.
Explore by using study of wind tunnel models for best configuration and number of stacks.
Involve architectural and engineering services, and municipal authorities having jurisdiction.
Deflect the discharge plume of the roof mounted cooling tower from vertical to horizontal so it will not enter the top of the stacks.
Provide stack structural support, and account for wind drag and Karman vortex action.
Provide spiral vortex spoilers on stack exterior to reduce drag and to prevent odour creeping up the stack on the lee (vacuum ) side of the stack.
Ensure stacks will not vibrate or oscillate due to wind action, or collapse in high winds.
Ensure stacks can be drained at the bottom.
Ensure all sheet metal work, including flex joints at roof level are leak tight against odour.
Provide means of access to stack interior and roof mounted duct for maintenance, and to keep them clean.
Size the stack cross section sufficiently large to minimize air friction losses and resistance due to

stack effect.
Review the building's existing free cooling option, the stacks may have to be sized accordingly.
Consider installation of booster fans on the roof to ensure adequate air supply at the HVAC units.
Provide lightning protection, bird screens, and rain protection sleeve at the top of the stacks.
Operate the building HVAC supply systems to keep the building pressurized at all times.
Install an air wash section inside the HVAC systems that use outdoor air.
Install a weather station for computer controlled optimization of the HVAC system.
Operate the HVAC systems at minimum outside air intake when the wind blows from the south.
Activate the HVAC systems air wash when the wind blows from the south.
Raise the antenna above stack height if required, or install an antenna tower remote from the building if necessary.

**For the Vault Ventilation System in the Main Building**

Close off the outside air intake located at grade level.
Consider using the main building general exhaust air to ventilate the vault. (This implies that the existing HVAC unit would not have to use outside air, and thereby avoid taking odours from outside at grade level).

**For the RCMP Shop Building**

Consider all of the above with regards to installing a fresh air intake stack on the roof of this building.
Review the use of the discharge air from the roof mounted HVAC unit - it can be used for additional duty.
Consider using the conditioned air returned from the shops area to be discharged into the garage area. With doors closed in the garage, this air may be useful in keeping outside odours at bay by pressurizing the non-conditioned garage space, should it become necessary.
Ensure the shop building is operated under positive pressure with respect to atmosphere.

**Composting Plant, Buildings, and Site**

To gain insight into the environmental conditions outside, the plant would benefit from a small weather station which may have more than one sensor location. For example relative humidity measured on the roof could be compared with relative humidity measured near the biofilter. Wind direction could be established, and acted upon when harvesting compost. For example compost harvesting may not be done while wind is blowing from the south, an administrative solution to control odour.

Plant management has purchased additional land on the south side of the plant to relocate the shipping and receiving function away from the RCMP building. The "function" component of the operation would also need to be addresses. Wet markets in population centres need to be washed down after every business day to clean the area of waste from animals, poultry, fish, vegetable and fruit. The same type of waste is being handled at this site in large volume, so the same cleaning principle should apply to the composting feed stock receiving area, and the compost harvesting area. A daily wash down ought to be incorporated into the operation of the plant, and stockpiles of waste materials should be covered or contained.

The plant has one biofilter for treatment of odourous exhaust air. The biofilter is sensitive to temperature and humidity extremes and may collapse. The beneficial organisms inside the filter die, thereby the filter seizes to function as per design intent. A dead filter bed may not necessarily be obvious to the plant operator, but it would become obvious on neighbouring properties due to strong odour emitted. The plant operator would rely on feedback from neighbours to identify and deal with the problem filter. Communication with the plant is very important.

While the filter is being refurbished, a task that takes days to complete, there is no other filter available to control odours at this site. It would be prudent to have more than one filter in operation for redundancy with sufficient capacity to allow continuous air filtration. It was also noted that the construction of the filter containment was substantial and made of concrete. Less costly and relocatable structures, as employed for horizontal silos in agriculture, may be useful to explore, as these light weight structures would be easy to relocate, or duplicate.

To combat the odour, natural odour neutralizers could be employed. These products are available in water based, alcohol based or oil emulsions, from a number of suppliers. Winter operation may dictate which product should be employed to avoid freezing. Distribution equipment has been developed and is available as well. This would consist of small high pressure distribution lines fitted with micron sized spray orifice. The lines would be about 4 metres off the ground around the plant site perimeter, and may be zoned such that only the downwind side would need to be activated. The weather station would make it possible to automate this process.

## Conclusion

### RCMP Buildings:

Unusual indoor air quality may be due to problems within the building, or due to the source of outside air being unsatisfactory. In this case, difficulties with building indoor air quality may be overcome to some extend, to accommodate the identified outside air source problem.

If the building is maintained under positive pressure, there is a chance that condensing conditions may prevail in some outside wall elements, and under the roof. Prolonged presence of free water is conducive to growth of mold which needs to be prevented. Operating the building under positive pressure is good, but needs to be carefully monitored. Positive pressure is obtained when supplied air is entering the building, but air exhaust is limited to prescribed requirements, such as sanitary exhaust. This mode of operation may only be necessary when the wind blows from the south.

If an air washer has been installed, high moisture content in indoor air may affect the fabric of the entire building, including structural components, building insulation, and roof membrane. This option should therefore be explored with care, and in context with existing HVAC systems and their design intent and operation.

If the fresh air intake is extended well above the height of the existing building, better quality outside air may be made available, but again, there will be effects on the existing HVAC systems. The HVAC systems operation will need to be optimized so the original design intent of the HVAC systems is not compromised. Input from a mechanical design engineer and the manufacturers of the existing HVAC systems should be sought.

If the installation of tall stacks is pursued, input from municipal authorities with respect to zoning may be required. The building architect may also need to be consulted if the architectural expression of the existing building is to be altered.

Existing energy conservation features are incorporated in the existing HVAC systems. The design allows for 100% outside air intake for free cooling and maximum ventilation. This option may have to be revisited with outside air intake being limited to the minimum volume recommended by **ASHRAE Standard 62.1-2004.** This limitation may only have to be activated when the wind blows from the south.

The outside air taken in may have to be washed and filtered with high efficiency filters to remove odourous substances. Taking in minimum prescribed outside air for building ventilation would aid this process. Air wash may only be necessary while the wind blows from the south.

Poor air quality in a location can identify that a building system may not function as per original design intent. People in charge of building operation need to be informed that the systems may not operate to satisfaction. Odour may originate inside the building, and it may be due to an electrical fault.

Reported odour information should be analyzed and compared to conditions prevailing outdoors. In this specific building, wrong assumptions may lead to wrong corrective action. When e-mail complaints are being sent to the composting plant, as per present agreement, the same message should be copied to the building operator for analysis. The complaint item may be an internal problem, (such as a hot electric light ballast causing the odour). Hot light ballasts may emit odours that are often identified as a “dead animal smell”.