Municipal Hazardous or Special Waste Lab Pack Sampling Program Final Report

Stewardship Ontario

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Executive Summary

2cg Inc. was retained by Stewardship Ontario through a competitive bid process to assist with the Municipal Hazardous or Special Waste Lab Pack Sampling Program (Study).

The goal of this Study was to identify the contents of 300 MHSW lab packs and categorize each item as a Phase 1 or non-Phase 1 material. The results of this work will be used by Stewardship Ontario to determine the appropriate cost share for MHSW lab packs containing both Phase 1 and non-Phase 1 MHSW.

The Study was undertaken at three separate locations from 22 April to 23 May 2008. Lab packs (205L lab packs) were sampled to determine the waste composition with regard to Phase 1 and non-Phase 1 materials. Lab pack categories that were sampled included:

- Paint & Coatings
- Flammables/Miscellaneous Organics
- Oxidizers
- Pesticides
- Aerosols

The sampling process included the following steps:

Step 1 – Open drum and record general information (e.g. drum ID number/code, drum fullness, product category, MOE waste class, etc);

Step 2 – Remove MHSW items from drum and group like products on sorting table;

Step 3 – Describe each item (e.g. type of product, container capacity, etc), record Phase (i.e. Phase 1, Non- Phase 1 , Unknown or Flagged for follow up later) and estimate fullness to the nearest quarter;

Step 4 – Enter data into computer; and

Step 5 – Repack items and reseal drum.

Sampling teams (Team) included, at minimum, a "caller" who identified each item and information about that item and a "data taker" who received and entered the called information. At times a third person acted as a "runner". They helped with unpacking, preliminary categorization and re-packing of lab packs. Different size sampling teams from 2-5 people were used. When there were 4 or 5 people, two sampling teams were set up.

This Study was a follow-up to a limited study undertaken by Stewardship Ontario in the fall of 2007. It represents the first full-scale study of this type in Ontario. A summary of sampling activities is provided in Table 1.

Table 1. Summary of Sampling Activities

	Company 1	Company 2	Company1	Company 3	Company 1	Total
Date	April 22-25	April 28-30	May 5-9	May 12-16	May 20-23	
Number of days on site	3.5	2.5	5	4.75	4	20.25
Total # Paint drums sampled	6	4	0	2	3	15
Total # Misc. org drums sampled	12	11	13	13	12	61
Total # Pesticide drums sampled	10	7	20	25	33	95
Total # Oxidizer drums sampled	8	9	29	11	44	101
Total # of Aerosol drums sampled	7	6	6	7	4	30
Total # of items sampled (all drums)	43	37	68	58	96	302
Total person days	**13**	**10**	**18.5**	**13**	**19.5**	**74**

A total of 302 lab packs were sampled. The study sample data is included in a separate spreadsheet file that 2cg provided to Stewardship Ontario.

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In general, this Study required more resources than anticipated. 2cg supplied 2-4 staff at any one time. This was a function of a number of reasons, including:

- Learning curve regarding item identification, calling and data taking
- Nomenclature development during the first 2-3 weeks of the study
- About 30% more items than anticipated (24,000 vs 18,000) in 302 lab packs
- Insufficient supply of lab packs at Company 2 which resulted in the requirement for additional sampling elsewhere

The Team sampling accuracy and speed improved throughout this study. By the last week the team (of 4-5) was sampling 19-29 lab packs per day.

The key requirements for any future studies include the following:

- Improved ventilation/fans etc. in sampling area
- Improved break structure and/or respiratory equipment
- Minimum sampling team compliment of 3 with a target of 12-15 lab packs per day (mindful that some lab packs take much longer to sample than others)
- Continued development and refinement of item nomenclature
- Continued development and refinement of data entry spreadsheets with consideration of separate forms for each lab pack type and further data entry automation via drop down menus (investigate practicality of a drop down for common item names)
- Sample multiple lab packs of the same type, whenever possible

Overall the goals and objectives of the Study were met. 2cg and Stewardship Ontario worked very diligently and cooperatively to achieve these outcomes.

1.0 Introduction

2cg Inc. was retained by Stewardship Ontario through a competitive bid process to assist with the Municipal Hazardous or Special Waste Lab Pack Sampling Program (Study).

The goal of this Study was to identify the contents of 300 MHSW lab packs and categorize each item as a Phase 1 or non-Phase 1 material. The results of this work will be used by Stewardship Ontario to determine the appropriate cost share for MHSW lab packs containing both Phase 1 and non-Phase 1 MHSW .

This report documents the sampling methods used for the Study and provides key lessons learned and recommendations by sampling location, type of activity and type of lab pack.

2.0 Methodology

The MHSW study was undertaken at three separate locations from 22 April through 23 May 2008. Lab packs (205L lab packs) were sampled to determine the waste composition with regard to Phase 1 and non-Phase 1 materials. Lab pack categories that were sampled included:

- Paint & Coatings
- Flammables/Miscellaneous Organics
- Oxidizers
- Pesticides
- Aerosols
- Batteries (1 lab pack)

The following equipment was utilized to facilitate sampling:

- Two sorting tables (folding tables or plywood on lab packs)
- Weigh scale (for battery sampling)
- 2 lab top computers
- 2 small tables for data entry
- 2 chairs
- Safety equipment (Tyvek suits, nitrile gloves, safety boots, safety glasses, hard hats, gas masks)

The sampling process included the following steps:

Step 1 – Open drum and record general information (e.g. drum ID number/code, drum fullness, product category, MOE waste class, etc);

Step 2 – Remove MHSW items from drum and group like products on sorting table;

Step 3 – Describe each item (e.g. type of product, container capacity, etc), record Phase (i.e. Phase 1, Non- Phase 1, Unknown or Flagged for follow up later) and estimate fullness to the nearest quarter;

Step 4 – Enter data into computer; and

Step 5 – Repack items and reseal drum.

Detailed sampling procedures and data requirements are provided in the *Municipal Hazardous or Special Waste Lab Pack Sampling Program Request for Proposals* issued by Waste Diversion Ontario and Stewardship Ontario in February 2008.

More information on sampling procedures specific to each sampling location is provided in Sections 3.1 to 3.2.2 of this report.

Sampling teams (Team) included, at minimum, a "caller" who identified each item and information about that item and a "data taker" who received and entered the called information. At times a third person acted as a "runner". They helped with unpacking, preliminary categorization and re-packing of lab packs. Different size sampling teams from 2-5 people were used. When there were 4 or 5 people, two sampling teams were set up.

The sampling teams consisted of 2cg staff (2-4), Stewardship Ontario staff and municipal staff.

All data was entered into Excel spreadsheets (provided by Stewardship Ontario) on laptop computers on location.

At the end of each week, data were sent to Stewardship Ontario for review and feedback.

3.0 Results

302 lab packs were sampled although it should be noted that they contained about 30% more items (i.e. 24,000 versus 18,000) than anticipated.

The actual results of the study are included in a separate spreadsheet file that 2cg provided to Stewardship Ontario.

Information is provided on sampling locations, lab pack sampling activities and specific lab pack types.

Table 3.1 provides a summary of sampling activities.

Table 3.1 Summary of Sampling Activities

	Company 1	Company 2	Company 1	Company 3	Company 1	Total
Date	April 22-25	April 28-30	May 5-9	May 12-16	May 20-23	
Number of days on site	3.5	2.5	5	4.75	4	20.25
Total # Paint drums sampled	6	4	0	2	3	15
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Total person days	13	10	18.5	13	19.5	74

Photos illustrating the general set up for sorting MHSW are provided in Appendix 1.

3.1 Lab Pack Sampling Locations

Company 1

Overview

Sampling took place in an enclosed building, which offered protection from the elements. Folding tables were provided to hold unpacked items removed from a lab pack. Laptops were set up on small tables facing the folding tables for data entry. The sampling area was not well-lit and required a spotlight to be provided for extra lighting. As the work took place in an industrial setting the area was quite dusty, leaving a film of dust on everything by the end of the day. The sampling area was out of the way of forklift traffic and large enough for comfortable movement of people and lab packs.

The requested lab packs were provided by staff. Items from lab packs were placed on tables and grouped into similar categories. After items were documented (i.e. called to data takers), they were placed back into the lab pack. Finished lab packs were marked with a sticker reading “Done” and placed off to the side.

Improvements

There is a need for better ventilation and/or respiratory equipment for the Team at this location.

Company 2

Overview

Sampling took place in an open-air building. The sampling area was situated close to an open bay door. The weather was very cold and rainy during the sampling time and the sampling location was extremely cold, especially for the data-takers, as they were sitting still for most of the day. It was also windy and quite dusty. Since the bay door was open there was more than adequate lighting and the draft kept the odor/fumes to a minimum. The sampling area was fairly small but manageable. However, the team was right in the line of forklift traffic so they had to be extra vigilant when work was being conducted around the Team. A table was constructed out of lab packs and a sheet of plywood. Laptops were set up on small tables facing the table for data entry.

Requested lab packs were provided by staff. The table was too small for two lab packs to be emptied at one time. Additional empty lab packs were provided by staff and items were removed one at a time from the sampling lab pack, documented and placed in the empty lab pack. As the volume decreased in a lab pack, several items were removed at a time and placed on the table as bending and reaching into the bottom of a lab pack for one item at a time became quite physically strenuous. Even though items weren't similarly grouped (i.e. this makes it easier for calling and data entry), this approach was also very efficient and may be more efficient than taking the time to remove all items and group them on the table. This approach works very well for a team of four people if empty lab packs are available. It should be noted that lab pack identification stickers were transferred to the new lab pack if the items were not placed back into the original lab pack. Finished lab packs were marked with a sticker reading "Done" and placed off to the side.

Improvements

There is a need for larger sorting tables and better shielding from the environment at this location.

Company 3

Overview

Sampling took place under a tent in the corner of the lot. The weather was sunny and mild, however a tarp had to be placed across the front of the tent to protect from wind. If the weather is very cold, this is not an ideal location for sampling. Walls or tarps must be put in place around the tent if the weather is rainy to protect the computers from moisture. Lighting was adequate and the wind usually kept the odor/fumes to a minimum. However, when there was no wind, fumes would collect and remain under the tent. The sampling area was situated out of the line of traffic and was large enough for easy maneuvering. Two folding tables were provided and covered with absorbent cloth to soak up leaks or spills. A laptop was set up on a small table facing the tables for data entry. One significant challenge that was presented at this location was the lack of on-site electricity. Additional computer batteries were purchased and data entry was completed on two computers, using one while the other was being charged in the office.

Requested lab packs were provided by staff. All items from a lab pack were placed on tables and grouped into similar categories. As items were documented, they were placed back into the lab pack. Finished lab packs were marked with a sticker reading "Done" and placed off to the side.

Improvements

It would be beneficial to have access to electricity on site and a ventilation fan to dissipate odours/fumes.

3.2 Lab Pack Sampling Activities

3.2.1 Activities

There were a number of activities undertaken during lab pack sampling including unpacking/packing, calling, data taking, data management, nomenclature, and team set-up. Key learnings and recommended improvements for each of these are provided below.

Unpacking/Packing

Unpacking of lab packs involved removal of items and staging of items for caller and data taker.

Key Learnings

In general, similar items were categorized and grouped together for ease of calling and data entry. Items were returned to the lab pack by the caller once all information had been relayed to the data taker. This method of unpacking and sampling was the most efficient for data entry.

A second method of unpacking/packing involved a full lab pack and an empty lab pack. Items were removed from a full lab pack one item at a time, information was called and the item was placed into the empty lab pack (this occurred when there was insufficient table space). Lab pack identification stickers had to be moved from the full to the empty lab pack. This method was very quick for the caller but more time consuming for the data taker since items were randomly called and no grouping of similar items took place.

Both methods are very effective. Transfer of items from a full lab pack to an empty lab pack could be employed in areas where limited space is available.

Improvements

There should always be sorting tables of sufficient size (i.e. to empty out full lab pack) at a sampling location.

Calling

Information including product name, Phase 1 yes or no, solid or liquid, container type, container capacity, container fullness and any other pertinent information were identified by the caller. The caller verbally relayed this information to the data taker.

Key Learnings

It is important for callers to be experienced, otherwise the calling process is much slower and sampling time per lab pack may be significantly increased.

It took some time for the caller to get used to the order in which the information needed to be presented to the data taker. Over time the accuracy and speed of "calling" improved.

Calling accuracy and speed may be increased by grouping common items typically found in a lab pack.

Accuracy and speed increased during the course of the Study. See Section 3.3 for information on processing times for various types of lab packs.

Improvements

A clear nomenclature method should be put in place for items not previously identified.

Data Taking

Information that was called was manually entered into a spreadsheet provided by Stewardship Ontario.

Key Learnings

The data taker needs to be familiar with a laptop and be a proficient typist. Entering information directly into a computer is more efficient than manual writing.

Accuracy and speed increased during the course of the Study.

Anything that can be used to help improve the speed of data-taking is critical. This includes further automation of the Excel data entry spreadsheets.

Improvements

Lab pack naming sheets including typical items found in a particular type of lab pack should be prepared.

Separate tabs for each type of lab pack (i.e. all pesticide drums entered into one sheet, all oxidizers into another etc.). Break "Product Name" into 2 columns, one for the main name and one for the product description. This will help because it will facilitate the inclusion of drop down menus for product description, which is not practical in the spreadsheet's current format (i.e. too many different items).

The volume/weight calculator in spreadsheets needs to be improved and accommodate the different types of materials encountered (i.e. metric/imperial measurements)

Data Management

Data entered into the computer in the field was checked at the end of each day for consistency, accuracy, errors and omissions and then edited where necessary.

Key Learnings

If two computers are being used, data needs to be consolidated into one file at the end of the day. Excel filter functions were used to help check the data. The container capacity needs to be converted into kilograms in the spreadsheet and sometimes this step was omitted during data entry because it was time consuming and the information was being called too quickly. This conversion column needs to be reviewed and edited each day after sampling has been completed.

A USB stick or external hard drive is useful for transferring data between computers. This also ensures that there is a backup of the data. Finalized data was sent to several team members nightly so it could be checked, as well as creating another backup of the data.

Improvements

None identified.

Nomenclature

A consistent naming system for MHSW items was refined and further developed during the Study.

Key Learnings

Product naming was not particularly structured and consistent at the beginning of this study. A request was made by Stewardship Ontario in the second week of the study to use nomenclature that had been used in the baseline study. However, there were many inconsistencies in this nomenclature and this had an impact on data taking and involved considerable after hours correction of the data. Over the course of the Study, a naming system that was much more consistent, easy to follow and incorporated most items was developed.

Naming of unidentified items should proceed in a "Genus, Species" fashion; the broad category followed by a more specific item name (e.g. insecticide - Diazinon (if a product name exists) or insecticide - wasp (if it is used for a specific purpose) followed by other descriptors or even the brand name if useful. In this way, most products can be grouped under distinct larger categories and will be more easily identifiable during data analysis. By way of another example, lamp oil would be recorded as "fuel – lamp oil" not just "lamp oil" which facilitates better filtering and comparison of fuel products.

Improvements

Further improvements could be made to this naming method. For example, automotive products are often difficult to classify under broad categories as they may have several different applications (e.g. a lubricant/penetrant/sealer/rust inhibitor). Since an improved

nomenclature base has been developed through this study, it should be used from the beginning of any new study.

3.2.2 Team Set-up

Throughout the study, a number of team configurations were tried to help optimize the sampling accuracy and speed.

Set-up between Data Taker and Caller

Key Learnings

The data taker and caller need to be in close proximity to relay information as the sampling sites were quite often noisy. The data taker was seated at a separate table.

Improvements

None identified

Set-up per team: Two vs. Three team members

Key Learnings

With 2 team members, there is always some down time when a new lab pack is unpacked. The data taker would help the caller unpack a lab pack and sort items on the table. During this time, no data entry occurred.

There was less down time with a team of 3 since one person ("runner") would be unpacking a lab pack while the other person ("caller") would be relaying information to the data taker. Once the first lab pack was complete, data could immediately be entered on the next lab pack while a third was being unpacked. While there is no down time for data entry with this method, there is some down time for one caller since it usually takes less time to unpack a lab pack than to document all items in a lab pack.

A 2 member team was able to sort between 9 and 12 lab packs a day. A 3 member team was able to sort between 9 and 14 lab packs a day. The lower part of these ranges occurred during the beginning of the Study. The types of lab packs being sorted also has an impact on sampling speed (e.g. flammables/misc. organics take longer than other lab packs) – see Section 3.3 for information on processing times for different types of lab packs.

Improvements

At minimum, a team of 3 people is needed to undertake this type of study. Further comments on sampling team size requirements are provided in Section 4.0 Conclusions.

Set-up of Multiple Teams

Key Learnings

A two team approach (two data takers and two callers) is very efficient since twice the amount of data is being entered. While the unpacking creates some down time in the data entry, as in the 2 person team approach, the double data entry more than makes up for this time.

Two teams were able to sort between 11 and 29 lab packs a day. The lower part of this range occurred during the beginning of the Study.

Improvements

None identified.

Set-up of 5 Team Members

Key Learnings

The approach to sorting when using 5 team members is similar to the 3 person team approach. While two teams are working on data entry, the fifth person acts as a "runner" between one or both Teams. The fifth person can bring new lab packs, close, label and remove finished lab packs and unpack the next lab packs while the caller is relaying information to the data taker. This is the most efficient approach to a study that requires a large volume of material to be sorted.

A team of 5 members was able to sort between 19 and 29 lab packs a day.

Improvements

None identified.

3.3 Lab pack Types

Aerosols

Key Learnings

Aerosol lab packs contained between 170 and 200 items. One aerosol lab pack takes approximately 1 hour to sample. However, by the end of the study, a simple lab pack (many similar items) was sampled in approximately ½ hour. Sampling speed is impacted by number of items (smaller cans account for more items in a lab pack) and similarity of items (easier and faster data entry). Aerosol lab packs contain insecticides, architectural paint, craft paint, insulation foam, cleaners/air fresheners, and miscellaneous car products. Phase 1 materials include architectural paint or coatings, non-automotive rust paint, spray solvents/degreasers.

Paint & Coatings

Key Learnings

Paint and coating lab packs contained as few as 20 and up to 145 items. One lab pack takes between 15 and 45 minutes to sample. Sorting speed is impacted by size, and therefore amount, of containers. Also, labels obscured by paint increases identification time for paint type and container capacity. Architectural paint, rust paint, coatings, finishes and furniture paint are Phase 1 materials. Any paint used for automobiles (including some rust paint) as well as craft paint, high heat paint or paint containing Bitumen are non-Phase 1 materials. Compounds that cannot be applied with a brush (e.g. grout sealer, spackling compound, creosote, poly filler) are generally non-Phase 1 or "unknown".

Pesticides

Key Learnings

Pesticide lab packs contained between 60 and 140 items. One lab packs takes between 40 minutes and 1 hour to sample. Sampling speed is impacted mainly by number of items per lab pack. Pesticide lab packs can be very odorous. They contain insecticides, herbicides, fungicides, rodenticides, animal repellents and personal bug repellents. The primary thing to look for when identifying a product as Phase 1 is the skull & crossbones in an octagon or diamond shape with the words "Danger" or "Warning" and "Poison". The next thing to look for is the PCP number. This number is usually very small and sometimes difficult to find. A triangle symbol with skull & crossbones or the words "Caution" and "Poison" excludes the product as a Phase 1 material.

Oxidizers

Key Learnings

Oxidizer lab packs contained between 10 and 85 items. One lab pack takes between 10 and 50 minutes to sample. Sampling speed is impacted by the number of items and type of items. Oxidizer lab packs are a mix of fertilizers, cleaning supplies, bleach and pool chemicals. Pool chemicals and cleaning supplies are very easy to document. Fertilizers take more time to document because there are more items in a lab pack and the Fertilizer Act number is often difficult to locate.

Flammables/Miscellaneous Organics

Key Learnings

Flammable/miscellaneous organics lab packs contained between 25 to 180 items. One lab pack takes between 20 minutes and 1 ½ hours to sample. Sampling speed is greatly impacted by number of items as well as product type. These lab packs can be among the most time consuming and challenging to sample. They are a "catch-all" for hazardous materials. They contain solvents, automotive products, antifreeze, de-icers, paint, oxidizers, fuels and an assortment of materials that do not fit into another category. Phase 1 materials include solvents intended to thin or dissolve other substances, alcohols, engine antifreeze, along with other items defined as Phase 1 from other categories. Non-Phase 1 materials

include windshield washer fluid, de-icers, fuels for camping, lamps, fondue, adhesives, fillers (e.g. Poly-filla), personal care products (lotion, shampoo, makeup).

3.4 Health and Safety

Safety equipment was provided by 2cg, including Tyvek suits, nitrile gloves, safety glasses, dust masks and respirator face pieces with multi-gas and vapour cartridges.

Key Learnings

Key emissions from lab packs include odours, fumes and dust. Normal close-fitting respiratory equipment (e.g. dust mist mask, face piece) is not practical for this type of project since information must be relayed verbally.

Most types of lab packs, at one time or another can be quite odorous. Fumes from aerosols, oxidizers (mainly containing pool chemicals or cleaners), pesticides and flammable/miscellaneous organics (mainly solvents) drums had at times short-term physical impacts on the Team. Fumes lingered in the enclosed sampling area. Even though some sampling was conducted outside, fumes collected under the tent when there was no wind. Lab packs containing vermiculite could become quite dusty when unpacking and packing items. Dust masks were utilized for this purpose but were not effective for fumes.

Callers spent most of the day moving around, unpacking, packing and moving lab packs. However, the data takers spent most of the day sitting at the computer which sometimes resulted in physical discomfort (headache, back ache, stiff shoulders, arms and fingers). Breaks were taken intermittently to get fresh air and move around.

Improvements

Additional efforts need to be made to dissipate odourous fumes from lab packs when sampling in enclosed areas. Fans may be useful for dissipating fumes and vermiculite dust. Superior respiratory or ventilation equipment may be required. If gas masks or hoods are used, they need to allow “calling” and “data-taker” verbal communication.

Regular short breaks need to be taken to get fresh air and move around.

Where possible and practical sampling should take place in well ventilated areas and/or outdoors in a tent.

4.0 Conclusions

This Study was a follow-up to a limited study undertaken by Stewardship Ontario in the fall of 2007. It represents the first full-scale study of this type in Ontario.

In general, this Study required more resources than anticipated. 2cg supplied 2-4 staff at any one time. This was a function of a number of reasons, including:

- Learning curve regarding item identification, calling and data taking
- Nomenclature development during the first 2-3 weeks of the study
- About 30% more items than anticipated (24,000 vs 18,000) in 302 lab packs

- Insufficient supply of lab packs at one location which resulted in the requirement for additional sampling elsewhere

The Team sampling accuracy and speed improved throughout this study. By the last week a team of 4-5 was sampling 19-29 lab packs per day.

The key requirements for any future studies include the following:

- Improved ventilation/fans etc. in sampling area
- Improved break structure and/or respiratory equipment
- Minimum sampling team compliment of 3 with a target of 12-15 lab packs per day (mindful that some lab packs take much longer to sample than others)
- Continued development and refinement of item nomenclature
- Continued development and refinement of data entry spreadsheets with consideration of separate forms for each lab pack type and further data entry automation via drop down menus (investigate practicality of a drop down for common item names)
- Sample multiple lab packs of the same type, whenever possible

Overall the goals and objectives of the Study were met. 2cg and Stewardship Ontario worked very diligently and cooperatively to achieve these outcomes.

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