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Long-term care facilities in Ontario, Canada: A waste management overview

Technical white paper report including calculations and presentation slides

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ABSTRACT

Long-term care (LTC) facilities are growing in number in the province of Ontario. Typically, Canadian LTC facilities house an average of over 100 residents. Environmental concerns associated to waste management in LTC facilities have not been fully explored, and relevant information is apparently limited in the available research literature. An independent study was conducted to investigate solid waste management in LTC facilities in Ontario. Both privately and municipally-owned LTC facilities were considered. The paper draws its observations from site visits, as well as interviews with facilitators and management of environmental services of LTC facilities. The study explores two main areas of waste management in LTC facilities; characterization of solid waste, and waste disposal criteria.

***Keywords**: Waste management, Solid waste characterization, Long-term care facility, Waste disposal, Hazardous waste, Environmental engineering, Solid waste policy*

ABOUT THE RESEARCH PROJECT

This document represents a public white paper report of three long term facilities studied in 2005. Permission to use the facilities by name was originally obtained though not exercised by the authors. The project began as an independent and self funded study while the lead author was attending the University of Ottawa as an undergraduate student. This project investigated both public and private facilities. Results were compiled in 2009 and presented as a paper at the IASTED International Conference on Environmental Management and Engineering. This paper can be referenced as such. This white paper also includes an additional appendix for calculations made, some grammatical/spelling corrections, new formatting, updated images and the original presentation slides used to relay information at the aforementioned conference.

For further details or for the full background documents please send the corresponding author an email.

1. INTRODUCTION

The population of seniors in Canada housed in long-term care (LTC) facilities is growing [1]. Long-term care facility residents are aged, suffer from a disease, or have a degree of impairment. A study by Zoutman in 2009[2] showed an average population of 127 residents in over 400 Canadian LTC facilities considered. In Ontario alone, over 600 facilities housed more than 70000 residents in 2005[1]. These large populations suggest that an environmental overview of solid waste and other environmental concerns should be conducted and addressed at these facilities. The main focus of this paper is to study solid waste management in LTC facilities. Hazardous waste management is also discussed briefly. To the knowledge of the authors, characterization of solid waste, disposal criteria, sanitation overviews, and collection of waste in LTC facilities have seen limited research attention in Ontario (and the rest of Canada). A study by Kim et al.[3] in 1994, described waste composition and generation with particular emphasis on food waste. Their study did not focus on multiple facilities and considered only one facility in the United States. Much of the past literature on waste management at LTC facilities describes analyzing food waste produced, however; these studies are limited to the United States[3-5]. Other available literature primarily focuses on hazardous waste in LTC facilities and not so much solid waste generations[6,7]. In an attempt to address this research need, an independent study was conducted to investigate the environmental practices of LTC facilities in Ontario, in 2005. The study draws its observations from three site visits, interviews and surveys with facilitators and managers of environmental services in LTC facilities. Both municipally and privately-owned facilities were considered in the study. This paper presents the findings of the environmental overview conducted, which considered the waste management practices of LTC facilities along with current (as of the date of the report) Ontario legislative background for these practices.

2.1 BACKGROUND AND METHODOLOGY

Data collection methods followed in this study focused primarily on personal tours at three LTC facilities in 2005: municipally-owned Facilities X and Y, as well as privately-owned Facility Z. To protect the integrity of the facilities surveyed, their names and any reference to their location have been omitted in this study. All three facilities are located in the same county in Ontario. Additional information on the size of the facilities can be found in Table 1. Each facility was found to have an approximate staff on duty to resident ratio of 0.2. This may not be representative of all facilities in Ontario, as facilitators explained that the staff size in LTC facilities is a function of the type of facility and its age.

Participation of each facility in this study was voluntary and arranged through initial contact with a local long-term care health organization. The organization approached six LTC facilities with a description of the environmental study to be conducted. Four facilities responded within the time frame allotted with interest in participating in the study. One of these facilities was omitted from the study, as it was undergoing a site transfer to a newly built LTC facility. The three remaining facilities were contacted directly to confirm the study details and objective. The objective of the study, as described to the facilitators, was to examine waste

management practices and waste composition at LTC facilities. Arrangements were made to tour the facilities and personally interview the senior management.

The surveys, interviews and tours commenced with the facilitator (lead administrator) and the environmental services manager of each facility. The focus of the interviews was to gain insight into the operations of each facility through the personal experiences of senior management, information on waste management practices (diversion rates, handling of hazardous wastes, etc.), and mass balance data (through inventory sheets and queries). A tour of the facility was then provided. The tours included the examination of janitorial facilities, waste disposal sites, resident living conditions, grounds, ventilation systems, kitchens, and storage rooms. These tours also made it possible to verify the validity of the information collected through interviews and surveys by inspection of the LTC facility sites.

The accuracy of this report is with reservation; surveys typically differ from manual sampling in waste percent composition. Yu and McLaren[8] showed in their study that the differences between these two methods were on average 50%. Staff may overestimate values reported in surveys, and too few samples may be used when carrying out manual sampling. Recent publications still rely on survey methods, such as the study published by Zoutman *et al.*[2], who conducted a national survey regarding infection prevention and control in long-term care facilities. Heung[5], also relied on a survey method to characterize food wastes in five LTC facilities in the United states with a resident participation of 34.5%. In this study, to compensate for possible errors in query and answer, personal interviews were conducted and inventory sheets were requested during the tours to validate claims. Instead of performing manual sampling, the principle of mass balance was used to analyze waste generation rates, providing a systematic analysis of the system[9]. The composition of the waste was characterized by breaking down the interview information, inventory sheets and surveys into separate categories. The mass balance model used for this study is described in Figure 1.

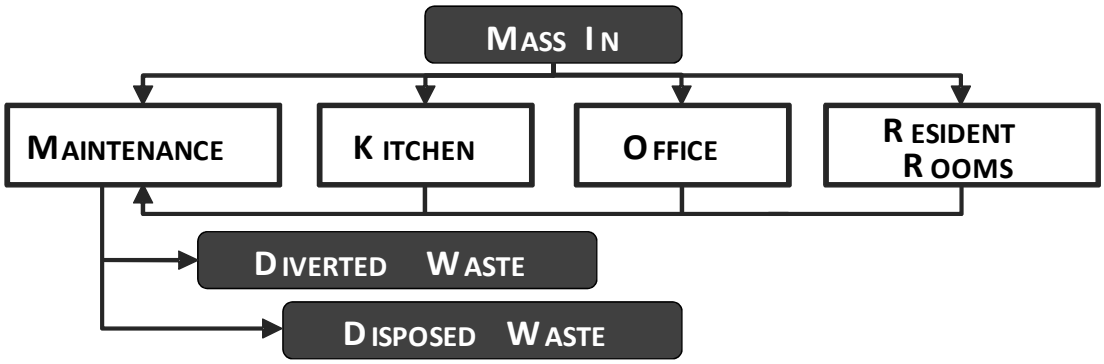

Figure 1: Simplified mass balance used in this study for utilization factor

It does not consider wastewater generated or methods of self-diversion by staff. It is crucial to understand that the study presented herein only represents a first step in a larger endeavor required to fully understand environmental practices in LTC facilities. Average percentages of waste going to different streams were found through interviewing staff members (Figure 2). Literature values[3, 10, 11] were used to calculate waste bulk densities and to estimate waste volumes. This allowed for

estimation of facility utilization factors (generation of waste compared to the capacity of the facility to accept waste) described in Table 1. The disposal site of each facility was examined and the theoretical capacity of the facility to handle waste was determined with the analysis conducted. In addition to this, provincial governmental legislation was examined with regards to LTC facility practices.

2.2 SOLID WASTE ISSUES

Evaluation of both present and future waste management initiatives at LTC facilities can be done by proper investigation of solid waste approaches such as collection and disposal practices. Hazardous waste contributes a significant portion of the overall waste generated by LTC facilities, but it is considered separately from solid waste due to its aesthetic and health properties and fixed generation levels (medications, etc.).

A distinction is often made between different types of solid wastes based on generation rates. Typically, waste generation is classified as Residential or ICI (Industrial, Commercial and Institutional). Residential waste generation is on average lower than ICI waste generation[12]. Industrial waste generation includes construction waste; commercial waste generation includes waste from offices; institutional waste generation includes waste from schools, hospitals, etc., and residential waste generation includes waste from family dwellings, apartments, etc. The operation of a LTC facility encompasses many characteristics from these different classifications. Each facility employs an administration staff that maintains and runs the LTC facility, accounting for office wastes.

Typical dwellings in LTC facilities consist of multi-dwelling rooms (two to four people) or private single rooms. On average in this study, two people occupy one room. Each room resembles an apartment unit; however, they do not include a kitchen. LTC facilities prepare three meals a day for residents in one large kitchen. Waste generated includes food wastes and wasted materials used in food preparation, such as cardboard boxes and steel cans. This particular set-up shares similarity with eating and drinking establishments, but typically, food choices are limited, reducing food preparation wastes.

Though LTC facility wastes may have similarities to waste from hospitals (also providing dependent care), both facilities generate waste at different rates. The interview process indicated that LTC facilities generate low levels of food wastes, which is not typical for institutions like hospitals [13]. This generation rate is contrary to the trend observed in the study by Kim et al.[3]. The reduction of waste in LTC facilities exists through a closer staff relationship with residents. Though meals are planned in advance, they can be tailored to the overall likes and dislikes of the residents, decreasing food waste as a result. This waste reduction method based on relationship building was observed in each of the three facilities toured.

3.1 WASTE GENERATION AND COMPOSITION

A mass balance of the entire facility was conducted through interviews based on four different areas; maintenance, kitchen, office, and resident room wastes as shown in Figure 1. Typical studies suggest that, as the population in a dwelling increase, the average amount of waste generated per person in the dwelling decreases[14]. This trend was observed in the two municipally-owned facilities. The rate of waste

generation was nearly identical in both facilities, but it was found to be slightly higher in Facility X (57 residents at 2.67 kg/capita/day) compared to Facility Y (100 residents at 2.44 kg/capita/day). An average waste generation rate of 2.56 kg/capita/day (including residents and average staff members working at one time) was determined for the municipally-owned LTC facilities. It was not possible to formulate a generation rate and percent composition from the waste data obtained for Facility Z's due to a large discrepancy in data.

For the purpose of this study, waste composition is separated into ten categories in Figure 2; food wastes, paper, cardboard, plastics, incontinents (diapers), rubber (some white wastes), staff wastes, aluminum, tin and other metals, and C&D (construction and demolition) wastes. The categories were selected as those likely to be found in the waste stream by survey and interviews with facilitators. A percent composition by volume of waste for facilities X and Y is shown in Figure 2. Some of these waste streams are described in more detail in this paper.

3.2 WASTE TYPES

Different waste types which contribute to the ten main categories described earlier are described in this section. These include food, paper, cardboard, plastic, incontinent, C&D, and white wastes.

The municipally-owned facilities directly manage what food is to be served to residents throughout the week. Facility Z, which is a privately-owned LTC facility, has less control over food choices, as the head office of the management company decides what food is to be served each day. However, it was found that Facility Z modifies its organizational plans on occasions to fit the preferences of the residents, much as is the practice in municipally-run facilities. When considering food wastes separately from the main waste stream, it was found that, as the population of the facility increased, so did the percentage of food waste reported (Figure 2), which did not correspond with the trend reported by Bolaane[14].

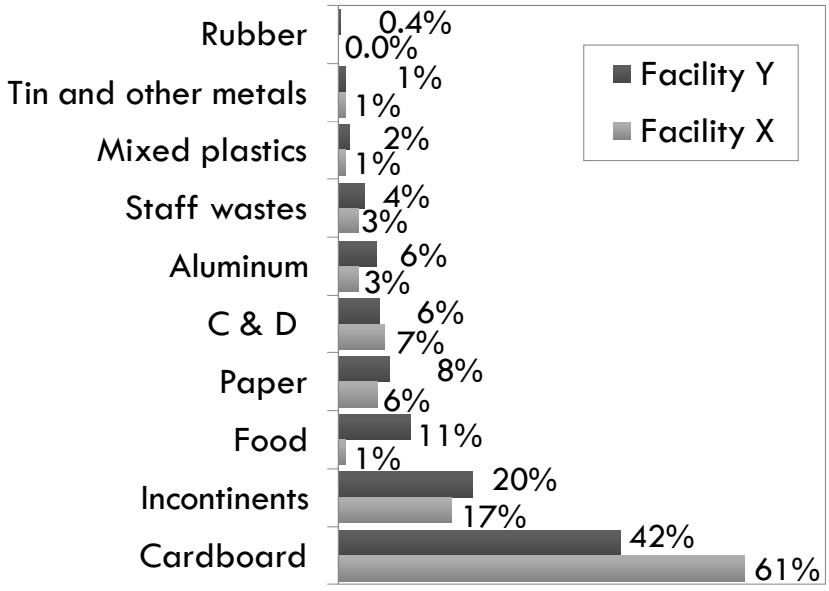

Figure 2: Volume percent composition of waste generated

Paper waste was analyzed in three separate streams; waste produced by maintenance staff for cleaning, office supplies (such as shredded paper), and newsprint. The office supply stream deals with the paper waste associated with the shredding of confidential records of resident care information. For this stream, it was necessary to consider the average number of staff members working at one time to determine the amount of paper waste accumulated in offices. Office paper shredding to protect resident confidentiality also presents the advantage of reducing the volume of discarded waste. This is especially important since recycling programs were nearly non-existent in two of the three LTC facilities studied (Facility X and Z). For Facility Y, where a recycling program was in place, a high diversion rate of paper wastes was noted. At this facility, seven different types of recyclables were collected and diverted from the main waste stream, including paper and newsprint.

Cardboard represented the biggest waste accumulation at sites (figure 2). Cardboard wastes constituted approximately 50% of the waste mass at Facilities X and Y. Though Facility X had the capacity to accept cardboard wastes separately, at the time of the study, it was not diverted, as specific collection services were unavailable to the facility, and thus cardboard waste was disposed weekly at the local landfill. Cardboard is the main carrying medium for over 800 kg of supplies delivered weekly at each facility. Larger facilities, like Facility Y, naturally accumulate more incoming mass per week.

Plastic wastes were minimal at LTC facilities; bulk materials were generally purchased for LTC facilities, such that the plastic component did not account for a substantial amount of mass of the incoming materials. Some examples of plastics disposed at these facilities include bulk containers for chemical products (laundry and housekeeping) and dietary food packaging.

One of the largest sources of waste (nearly 20% for facilities X and Y from figure 2) at LTC facilities is incontinent products. Incontinent products include soiled diapers. They are a mixed stream of waste consisting of some plastic quantities. Incontinent products cannot be reduced nor diverted. The average resident age at the LTC facilities surveyed was over 85 years. The nature of dementia in many residents incapacitates motor functions in later stages of disease and the demand for these products becomes higher. All facilities were found to have similar generation rates of this type of waste.

Perhaps the least frequently considered waste stream from LTC facilities is that of C&D waste. According to facilitators, older facilities are progressively being closed down, as they are usually more communal and less private. Facilities Y and Z were both built in 1977; while Facility X was built in 1997. The age and level of maintenance of a facility influence greatly the C&D waste generation of that facility. The interview process revealed that facilities typically undergo numerous renovations throughout the life of the buildings. Types of renovation projects include reconstruction of roofing, redesigning and expansion of rooms, wall re-painting, general maintenance, etc. The effect of constructing facility expansions should also be considered to contribute to C&D waste generation. Facilities can undergo expansion projects that may take a large course of time to plan and complete. Facility Y was in the preliminary planning stages for an expansion project as of 2005. By spreading the tipping fees for building materials and the demolition costs over

the expected usage life of a building, it is possible to account for the average C&D waste generated annually by a LTC facility[15]. This can be misleading, however. Facility X's predecessor was sold to private interests, thus absolving the facility of any demolition expenses. C&D reduction can also be achieved by transferring various materials from older facilities. Facility X achieved this by transferring and reusing an old gazebo from a recently closed LTC facility. Interviews with facilitators suggested that the reuse of previous structures brought comfort to those who suffered from dementia such as Alzheimer's disease. The structures triggered certain positive emotions in residents associated with past memories of the recently closed LTC facility where they previously lived.

White wastes consist of large objects needing disposal, such as old dryers, washing machines, wheelchairs, etc. Each facility has its own standard practices when dealing with the diversion of these types of waste from the main waste stream. Though some of the wheelchair components are recyclable, an average of four wheelchairs per annum were disposed into the main waste stream at Facility Y. Rubber and various metals can enter the waste stream of a LTC facility as a result. Facility X practiced a method of diversion by auctioning off its white wastes.

4. HAZARADOUS WASTE

Hazardous waste generated at LTC facilities are generally the product of the sanitary and healthcare provisions required by the LTC facility. Cleaning chemicals, medications, administration of pharmaceutical drugs to residents, all contribute to this waste stream as well. Most of the collection of hazardous wastes at municipally-owned LTC facilities is handled through local pharmacies. This arrangement allows for a local pharmacy to develop an independent relationship with the LTC facility. The LTC facility brings business to a local pharmacy where it purchases pharmaceuticals, and the pharmacy in turn handles the accumulated clinical waste created by its services. Hazardous waste is locked and stored safely on–site, away from residents and collected quarterly by the pharmacy. With regards to chemical waste, it was found that each facility disposed a diluted stream of chemicals as water waste. As of 2005, Ontario standards required that chemical waste is to be diluted and proportioned in usage according to section O in the *LTC home program manual: Environmental Services section guidelines* (ESSG)[16]. The manual's last major revision was in 2007 and Section O guidelines have not been updated since 1998[16].

5. WASTE DISPOSAL

Proper disposal and transportation of solid waste in a LTC facility is crucial to the health and safety of its residents. The ministry of Health and Long-term Care (MOHTC) has established a list of protocols and standards to which each facility must adhere[17]. Annually, the MOHTC in from Ontario makes an unannounced inspection of each facility. Disposal and collection systems are included in the facility inspections. The results of each inspection are publicly available on the Ontario Ministry of Health's website. All facilities toured were found to pass environmental regulations set out by the Ontario government as of 2005.

The capacity of each facility to accept wastes varies. Also, although a facility may have a higher waste capacity, if recycling measures are not established on site, then its diversion capacity decreases. Facility Y had recycling services. Although local

municipal recycling collection was available at the locations of Facilities X and Z, these two LTC facilities were not offered recycling services by the municipality, and their entire waste stream was sent to landfills, with the exception of self-diversion practiced by some individuals (i.e. collection of aluminum cans). Table 1 shows some statistics for each facility related to their waste disposal practices.

Transportation and collection of wastes for each LTC facility surveyed is under contract with a privately-owned local environmental company. The company has the ability to handle three waste streams; recycling, composting, and municipal waste. ICI wastes fall under a separate private municipal waste contract and ICI waste pick up must be negotiated with the local environmental services company for municipally owned facilities. In the county where all three facilities surveyed are located, LTC facilities are regarded as ICI facilities by the local environmental company. For this reason, some facilities like X (which is municipally-owned) do not have a recycling contract yet with an environmental services company.

The distance between each LTC facility and the locations of the closest MRF (municipal resource and recovery facility) and landfills were computed using GIS (geographic information system). The values reported in Table 1 suggest that the location of the landfill (owned and managed by the environmental company) has a direct impact on the frequency of waste collection at the LTC facility, while no trend can be identified between waste collection frequency and distance of the facility to the MRF. Facility X was found to have the highest capacity (ability to collect and store waste) for solid waste and is located closest to the landfill. The facility had the highest frequency of collection at twice per week. Facility Y was found to be close to the MRF and had the highest diversion rate of waste. In analyzing the frequency of collection, Facility Y had the lowest of the three facilities toured at once per week as well as the highest generation of waste (table 1). Facility Z was the closest to both the MRF and the landfill. The privately-owned Facility Z was also unique in that a third party contractor works with the environmental company to handle the facility's waste disposal. The frequency of collection was twice per week at Facility Z. In 2005, there were no waste diversion services at Facility Z, despite being closest to the MRF. At the time of the study, management at Facility Z had been in negotiations with the environmental company for inclusion in recycling services for over two years.

The lowest frequency of collection at an LTC facility is once per week for every waste storage station, as per ESSG clause O1.7[16]. All facilities in this study received waste collection services at least once per week. The main purpose of this guideline is to prevent waste from becoming stagnant and attracting pests. However; the clause is vague in regards to waste diversion programs. In the county where all three LTC facilities were located, recyclables were collected bi-weekly at the time of the study. According to the facilitators of Facility Y, most recyclables and divertible products do not share the biodegradability characteristics of other wastes such as food, which can attract pests. The provincial guidelines[16] are thus relaxed to account for collection of recyclables (i.e. newsprint and cardboard) during government inspections. Pests can become a severe problem as a consequence of waste storage at a LTC facility. Based on the information gathered during interviews, the more common pests found at the LTC facilities were raccoons. ESSG Clause O1.6[16] stipulates that each storage container must be designed to keep insects and rodents out. When a container exceeds its volume capacity however, the container is

vulnerable to these pests. The utilization rate at Facilities X and Y was low enough that this was not a concern (Table 1).

Table 1: Waste disposal specifics for each LTC facility

Facility	Number of residents	Volume Capacity per week	Average volume of waste	Utilization factor as percent	Composting program (Y/N)	Recycling program (Y/N)	Distance from MRF	Distance from landfill
		(m^3)	(m^3)				(km)	(km)
X[A]	57	825	504	61	N	N	41.4	25.2
Y[A]	100	735	565	77	N	Y	34.7	36.1
Z[B]	60	426	—	—	N	N	26.7	27.0

Notes: [A]-Publically owned
[B]- Private owned

6. DISCUSSION

Municipally-owned LTC facilities have an advantage over privately-owned facilities in terms of waste disposal, as they are operated by the municipality. For the three facilities considered, it was found that the larger a facility the higher its waste generation rate. To compensate for this, municipally-owned Facility Y had sought to purchase a compactor. Though a compactor would certainly decrease the volume of waste generated by the facility, compactors would introduce three problems to the facility. The compactor's noise levels may be irritable to the residents, a foul smell could develop (in violation to ESSG clause O3.4[16]), and the potential for attracting insects could be increased if the compactor was not cleaned regularly. A solution to these problems would be to move the proposed compactor away from the facility, which would isolate the insects, smell, and noise concerns from the LTC facility. However, ESSG clause O1.6[16] states that waste storage stations have to be adjacent to the LTC buildings as transportation of the waste over longer distances would be in violation of this clause.

Other initiatives which can be considered include composting. At the time of the study, yard wastes were not collected from the LTC facilities toured. Yard wastes were generally left to naturally decompose on the ground, and not diverted to composting, as this program was unavailable at the time. Institutional waste sources are found to have food wastes generating nearly 50% of their total waste streams [13]. Each facility indicated that the more personal relationship between staff and residents allowed for decreased food wastes at LTC facilities compared to institutional sources. Waste contracts are not directly needed to run an adequate composting program at a LTC facility, only a large amount of biodegradable waste products are needed. Two factors prevented direct on-site composting at the LTC facility. The first is ESSG clause O1.9[16], which states that waste storage containers must be emptied weekly, such that waste would not have the required time to biodegrade. Secondly, at the time of the study, management at the facilities toured considered the amount of biodegradable waste produced to be too small in volume to require diversion. It is unlikely that composting programs will be considered at the LTC facilities audited in this study.

7. CONCLUSION

By investigating only three facilities, this study does not have a sufficient sample size to provide a representative view of LTC facilities in Canada (or Ontario) as a whole. However, it does provide an initial outlook into waste management practices at LTC facilities. A brief overview of Ontario legislation used in 2005 and its guidelines in relation to solid waste management practices for LTC facilities is provided herein, along with the challenges that are faced by LTC facilities as a result. Compliance to legislative guidelines for waste handling at LTC facilities is often in conflict with potential waste diversion initiatives considered, such as compaction, recycling or composting. Surveys and interviews with senior staff were successful in generating data for municipally-owned Facilities X and Y. However; they failed to account for waste generation and composition for the privately-owned Facility Z. Further studies should be undertaken by revisiting each site to investigate waste generation and characterization over time. Additionally, a similar study performed on a larger and more representative sample size using manual sampling to characterize the waste of each facility would allow for a more accurate understanding of particular wastes in LTC facilities.

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Appendix A: Waste generation and volume sample calculations

Sample Calculations for LTC

Bulk densities taken from Solid waste management, Vesiland, 2002 Appendix B, where calculated values only included volume. Sample using one facility raw data taken from inventory sheets, observations, and interviews. Calculations below are just a sample of the methodology employed in calculating and do not necessary reflect utilized values.

Food wastes:

Total mass of food 1 week = 840 kg~1851.88 lbs

Total mass of food 1 year = 96297.76 lbs

Food wasted @ 5% of total stream mass of food = 0.05*96297.76lbs = 4804.8 lbs/yr

Calculation notes: food wasted percent represents total stream mass of food and is approximate to account for packaging wastes through interviews.

Paper wastes:

Newspaper = 1,2lb/paper*6 days/week * 8 papers/day *52weeks/year = 2995.2lbs

Office Paper = 90lbs paper per employee/yr * 39 employees working each day= 3510lbs

Cleaning paper= 80kgs/week*52 weeks/year = 4160kg=9152lbs/yr

Total paper mass= 9152+2995.2+3510= 15657lbs/yr

Calculation notes: 90 lbs paper year is an average estimate taken for employee waste amongst staff, 39 employees work per year.

Cardboard:

Cardboard= 8conatiner volume(yd^3)*0.55*350 lb/yd^3 *52 weeks/yr= 78624lb/yr

Calculation notes: Assumes container holds 55% cardboard in its total volume, based on observation, and interview

Mixed Plastics:
Mixed plastic= 2% * 250 kg/week= 5kg week = 11.02 lbs/week= 563.2 lbs/yr

Calculation notes: total mass in a week equals 250kg of plastic products, which are composed of an estimate of 2 % plastics. This value does not include incontinent products

Incontinents (diapers):
Incontinent: 19.33 cases per week * 52 weeks/yr * 5.86 kg/case* 1.50 =8835.35kg/yr=19367.39 lbs/yr

Calculation notes: Assumes 50% moisture of soiled disposable diaper(interviews). Diapers are included in the textiles column, as there is clothing wastes accumulated here. This number is likely an underestimate as clothing is not accounted, and moisture seems low

Rubber:
Cleaning Rubber= 18kgs/week * 52weeks/year=936kg = 2059.2 lbs/yr

Calculation notes: From rubber cleaning gloves

Staff wastes:
Effective staff members: Effective staff members are computed based on the number of staff members working on average at any given time.

Effective staff = 39 meals total served to staff/ 3 meals per day = 13 effective staff members

Staff wastes: 13 people*0.88lbs/captia/day * 7 days/week* 52 weeks/year= 4205.8lb/yr

Calculation notes: Staff generation rate includes food wastes, plastic wastes, and metal wastes, this percentage is taken from the 2003 EPA and multiplied by an average generation rate of 2.4 lb/capita/day found in table 2.1.

Metals:
Amount of material packaged in metals = 0.3*96297.76lbs/yr= 28889.328lbs/yr

Assumption that 5% of this is packaged with aluminum = 0.05*28889.328lbs/yr = 1444.5lbs/yr

Assumption that 2% of this is packaged with steel = 0.02* 28889.328 lbs/yr = 577.78 lbs/yr

Calculation notes: main assumption is that metals are used for packaging in 30% incoming food stream.

C&D Wastes:

Annual C&D cost= 2 million dollars/20 years + 80 000 dollars/per year of renovation= $180 000/yr

Mass of C&D wastes = $180 000/ $8.25/lb = 21, 8181 lbs/yr

Calculation notes: Stenis (2005) showed that a project of 1.734 million dollars accounted for 105 tons of waste. Which projected to 16500 dollars per ton, which reduced to 8.25 dollars per pound. Stenis excluded tipping costs. Projection based on trends at LTC is that a major expansion, or life of the building is limited to every 20 years. The projection is that the cost of this is 2 million dollars from interviews.

Total Mass in

Total mass= summation of masses= 150597.76 lbs

Total volume accounted

Calculation notes: volume= mass/bulk density
bulk densities taken from Solid waste management, Vesiland, 2003 Appendix b. C&D waste bulk density referenced as 480 lb/yd ^3 Bulk Density from, Innovative Recycling Grants (IRG) (2001). for Okaloosa, Citrus, Putnum Counties and the New River Solid Waste Association, "Recycling of Discarded Gypsum Drywall in Florida", a report submitted to the Florida Department of Environmental Protection, prepared by the University of Florida Dept. Environmental Engineering Sciences.

Generation rate for overall facility including staff

Generation rate =(150597.76lbs / 365days)/(13+57 people)=5.9lb/captia/day

Generation rate for overall facility excluding staff and C&D wastes

Generation rate =(150597.76lbs- 4205.80- 21818.00 / 365days)/(57 people)=6.0 lb/captia/day

LONG-TERM CARE FACILITIES IN ONTARIO, CANADA: A WASTE MANAGEMENT OVERVIEW

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Introduction

- Long-Term Care (LTC) facility residents are aged or have a degree of impairment such that they need constant care and supervision.
- The population of LTC facilities in Canada is growing.
- In Ontario, 600 LTC facilities house over 70,000 residents.
- Numbers suggest that an overview of solid waste management and other environmental concerns should be undertaken.

Background

- To date, limited studies have been conducted on solid waste issues in LTC facilities in Ontario (and the rest of Canada).
- Research has been performed to quantify hazardous waste in LTC facilities (Singh 2004, Rutala 1992).
- Most studies have focused on dietary quantifications of food waste and have ignored other solid waste streams (Kim 1997, Nichols 2002, Huang 2002).
- These studies have been limited to the United States and had limited resident participation and involvement.

Methodology

- The current study considers three LTC facilities:
  - one privately-owned (denoted Facility Z here), and
  - two municipally-owned (denoted Facilities X and Y here).
- All facilities were located in the same county of Ontario.
- The population of each facility ranged from 50 to 100 residents, with an approximate staff on duty to resident ratio of 0.2.
- Participation to the study was voluntary and arranged with the help of a local health organization.

Methodology

- The objective was to examine waste management practices and waste composition at LTC facilities.
- Waste information was collected through:
  - surveys, interviews (with staff and facilitators), inventory sheets and sight tours in late 2005.
- In a effort to validate surveys and interviews, tours involved examination of:
  - janitorial facilities, disposal sites, living conditions, grounds, ventilation systems, kitchens, and storage rooms.

Solid Waste Issues at LTCs

- LTC waste streams have characteristics from both Residential and ICI (Industrial-Commercial-Institutional) waste streams classifications.
- Construction, commercial (office), hospital, and residential dwelling wastes are all produced at LTC facilities.
- Kitchen waste generated shares similarities to waste generated at restaurants, but it differs in that food choices are limited in LTC facilities and a closer relationship exists between staff and residents.
- Food wastes were seen to be lower at the LTC facilities in comparison to generation at a hospital and other studies.

Mass Balance

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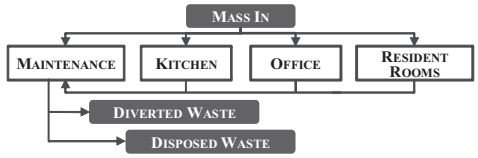
- A mass balance approach was used to classify waste from LTC facilities:



  - This mass balance did not consider self-diversion by staff which was difficult to quantify.

Generation of Wastes

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- Preliminary estimates were obtained for waste generated for the municipally-owned facilities (Facilities X and Y).
  - Facility X produced waste at 2.67 kg/capita/day.
  - Facility Y produced waste at 2.44 kg/capita/day.
- Discrepancies in the waste data obtained for Facility Z prevented the estimation of a waste generation rate.
- These numbers are based on the number of residents and the average number of staff members working at any one time.

Waste Types

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- The study specifically focused on the following waste streams:
  - Food
  - Aluminum
  - Tin and other metals
  - Mixed plastics
  - Construction and demolition
  - Paper
  - Incontinents (diapers)
  - Cardboard
  - Rubber
  - Staff wastes

Waste Types

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- Some trends that were observed included;
  - As the population increased in a LTC facility, so did the percentage of food waste.
  - Paper shredding was used to reduce the size of paper wastes as no recycling programs were available to Facilities X and Z.
  - Cardboard waste generation was high, as cardboard was the main carrying medium for bulk materials.
  - Construction and demolition wastes were considered based on facility life and demolition/reconstruction costs.

Waste Composition

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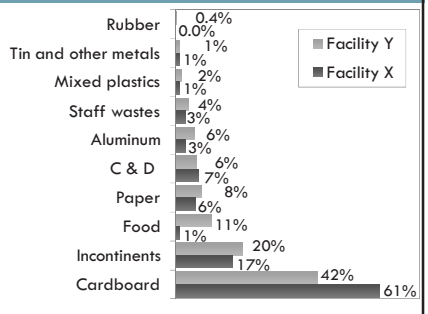
- Percentage of waste composition (by volume) for municipally-owned Facilities X and Y



Hazardous Wastes

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- Hazardous waste is generally produced as a result of medicinal healthcare that may be hazardous to the handler (can include other types).
- In municipally-owned facilities, the collection of clinical waste is typically carried out by pharmaceutical companies quarterly based on a mutual relationship of providing and disposal.
- Chemical waste is typically diluted and proportioned in line with section O of the LTC environmental service guidelines.

Waste Disposal

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- The Ontario Ministry of Health and Long-Term Care (MOHTC) has established a list of protocols for safe storage and disposal of wastes on LTC sites.
- Annually, the MOHTC inspects each facility for waste disposal practices and its findings are made available to the general public.
- Each facility toured was found to pass the guidelines laid out by the MOHTC.

Waste Disposal

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- Typical statistics relating to each facility for waste disposal and collection.

Facility	Number of residents	Total waste capacity (m^3/yr)	Average waste generation (m^3/yr)	Utilization factor (%)	Composting program	Recycling program	Distance from MRF (km)	Distance from landfill (km)
X	57	825	504	61	No	No	41.4	25.2
Y	100	735	565	77	No	Yes	34.7	36.1
Z	60	426	—	—	No	No	26.7	27.0

Waste Disposal

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- The distances between the facilities and landfill/MRFs were computed using a Geographic Information System.
- The trend observed indicated that the location of the facility to the landfill had a direct correlation to the frequency of collection.
- Recycling initiatives do not exist at Facilities X and Z.
  - Facility X is located too far to be profitable for the MRF.
  - Facility Z (privately-owned) is classified as an ICI facility and is required to negotiate a contract with an environmental collection service.

Discussion

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- Various guidelines affect the ability of a facility to reduce and store waste;
  - The proposed use of a compactor would be in violation of noise and smell regulations. Moving the compactor away from the facility would require another regulation violation to transport waste across the facility grounds.
  - Composting could be initiated, but waste cannot be stored on site for more than a week.
  - In some cases, guidelines are relaxed (recyclables may be collected bi-weekly instead of weekly, for example).

Conclusion

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- Investigation of these three facilities is by no means a fully representative view of LTC facilities in Ontario or in Canada.
- It does however provide an initial look into waste management practices at LTC facilities and provides an insight into potential reasons for the availability or unavailability of disposal programs.
- Further studies could be undertaken to investigate waste generation and characterization over a longer period of time at these or other facilities.

Questions or Comments?

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- Thank you for your time.
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- Ontario standards information can be found at:
  - http://www.health.gov.on.ca/english/providers/pub/manuals/ltc_homes/ltc_homes.pdf