BOMA BEST
BUILDING CERTIFICATION PROGRAM

Waste Auditing Guiding Principles

A Guide to Understanding Waste

Improving the performance of waste management in a building requires knowledge regarding the nature and mass of waste collected on-site. While it is possible to have a rough idea of the diversion rate based on data provided by waste haulers in regards to materials destined for landfill, those that can be recycled and composted, this information is not always based on weighted data, making a reliable analysis of a building's performance impossible.

Regular auditing of the waste generated on a site is therefore recommended. At a minimum, a waste audit should be carried out every three (3) years. Annual audits are recommended. Auditing is a scientific approach aimed at collecting precise data about the characteristics of waste, including its mass, composition, waste stream and methods of disposal. To be credible, auditing should be conducted using a trustworthy methodology. In addition, it should clearly establish the different criteria and methods of evaluation, as outlined in an initial protocol.

This document was created with the help of the BOMA Quebec Task Force on Waste Management, the BOMA Canada Technical Committee, and the Recycling Council of Ontario.

Note to readers: For a list of the practices required to meet the Waste Auditing baseline practice, consult the BOMA BEST Waste Auditing Requirements. Although these requirements are reiterated here, this document goes above and beyond, providing readers with insights into practices recommended by the industry. As such, not all practices listed here are required.

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1. What is a Waste Audit?

The audit process involves collecting, sorting and categorizing waste in order to obtain a statistical picture of the quantities of waste generated at a particular site along with their methods of disposal. The process is carried out over a number of representative days, and the results are extrapolated over a year in order to provide an idea of the building or site's performance.

2. What is the Purpose of a Waste Audit?

The key objective of an audit is to verify annual service reports and diversion claims. It is the key document upon which is based, and which supports, future management decisions.

An audit aims to identify the specific characteristics of a building and its occupants in terms of waste mass, composition, waste stream and methods of disposal. It serves not only to assess a particular building, but also to compare it with other buildings using equivalent criteria.

Thanks to the audit, building managers and operators are provided with a firm understanding of the nature and mass of waste generated at the building.

In addition to providing information about waste characteristics, a waste audit identifies potential measures to increase the diversion of waste from disposal in landfills. A waste audit also serves to establish the contamination rate for different waste streams so that these can be targeted and improved through specific initiatives. The building manager will then be able to optimize waste management thus reducing operating costs, improving the diversion rate.

The audit can be general in nature, to determine the overall performance of a building, or detailed, to assess the performance of each department in the building.

3. Pre-audit practices

Different criteria must be respected so that the data gathered can be used, compared, analyzed and disseminated. Before the audit begins, the methodology for performing the waste audit must be developed, the auditing plan. This methodology must be respected and adhered to throughout the process otherwise bias may be introduced, distorting the results.

Every waste audit professional has developed his or her own methodology over the years. The methodology selected must always be adapted to the needs and particular characteristics of each client and each site. Sound methodology takes into account the specific nature of the site assessed in order to obtain precise, consistent results that correspond to the building manager's requirements.

3.1. Selecting an audit team

The audit must be performed by a person with adequate qualifications as well as suitable training and experience. This will ensure that the results are reliable and that recommendations will be based on what is best for the property in terms of increasing diversion and reducing costs.

The person performing the Waste Audit must be competent based on the following criteria:

- Adequate qualifications – the person has a good working knowledge and understanding of the legislation surrounding waste;
- Suitable training – the person must have training that is appropriate to performing a waste audit and which complies with provincial minimum safety training requirements; and
- Sufficient experience – the person must have enough experience to safely perform the work without supervision or with only a minimal degree of supervision.

Although not required, it is strongly recommended that the audit be performed by a third party. Doing so will ensure an objective and transparent assessment.

3.2. Create an auditing plan

The audit plan should be developed by the audit team leader in agreement with the audit client. The audit plan describes the activities and arrangements for the audit. The methodology selected must **always be adapted to the needs and particular characteristics of each client and each site**. Sound methodology takes into account the specific nature of the site assessed in order to obtain precise, consistent results that correspond to the building manager's requirements.

The audit plan must include the following considerations:

i. Audit profile

It provides an overview of the current waste management program and the activities, products and services being performed at the site. The profile should consider the number of operational days at the site, the size of the facility, and other sector-specific data that may impact the amount and nature of waste being generated. The profile can also include the waste generation index and the NAICS code for the facility.

ii. Audit scope

It describes the sampling time period, activities and geographic locations to be included in the audit. Defined by the audit client and confirmed by the audit team leader. Includes:

- Scope of materials:

Determine which materials will be included in the audit and which will not be included. For a full list of material categories, please see Appendix 2 at the end of this document.

Waste can be separated into **four distinct main categories**:

1. Daily Waste
   These materials come from everyday single-use or limited consumer products and include paper, packaging, food waste, plastics, containers, etc.
2. Durable Goods
   This category consists of equipment, tools and objects that have a longer life cycle, such as furniture, appliances, electrical equipment, computers, electronics, etc. They are often disposed of separately from daily waste.
3. Construction/Renovation/Demolition (CRD)
   CRD waste results from building construction projects, and are considered separate from daily waste.
4. Hazardous Materials
   Hazardous materials include batteries, fluorescent light tubes, ballasts and chemical products, paints and solvents containers, refrigerants, cleaning agents, motor oil and propane cylinders. This type of waste is subject to special methods of disposal, dependant on the applicable rules and regulations. Hazardous materials should never be placed into the regular disposal receptacles, but should instead be recovered by specialized firms that will recycle or properly dispose of the material.

Distinguishing between these four categories of waste is essential. Durable goods, CRD waste and hazardous materials are generated sporadically, and should not be disposed of in the same fashion as daily waste.

Once the main waste categories have been established, waste can be further divided into **sub-categories** to classify waste collected in terms of type. For example, the main category “Daily Waste” can be further divided into the following sub-categories: aluminum, glass, paper, cardboard, organics, etc. Appendix 2 provides a detailed list of possible sub-categories.

Sub-categories are used to distinguish between materials that are generated by the building occupants and waste related to specific activities. For example, an archiving centre may prefer to create two separate sub-categories for paper; one for paper generated through regular activities and the other for paper generated through document removal.

Only some sub-categories may be relevant in a given municipality. Proper identification of the sub-categories is a critical component of the waste audit.

Precise and informed categorization of waste is essential in order to compare the performance of different buildings year over year.

Include: Any solid waste generated at the site during regular activities. If a material is included in the annual diversion rate calculation, it must be included in this audit. Generally speaking, include materials such as hazardous materials (though this is not required) and durable goods.

Do not include: Any material that is generated through temporary or atypical activities. Materials generated through atypical activities should have their own audit (not part of the BOMA BEST compliant audit scope). Generally speaking, exclude materials generated through construction, renovation and demolition (unless you intend to include it in the annual diversion rate calculation). If construction, renovation or demolition waste is included, provide information specific to this type of waste.

- Sample Size and Date:

Determine an appropriate sample size and date (determined by the audit client and verified by the auditor as being sufficiently representative).

Select a sampling period that reflects "regular" work. Avoid vacation periods such as July and December, statutory holidays, and special events. Sampling must cover a normal period of the year. This will allow for data extrapolation of data. Avoid vacation periods such as July and December, statutory holidays, and special events.

At a minimum, the sample size selected must capture at least 10% of the facility's daily waste generation based on typical operations. Best industry practices recommend that auditing be undertaken over a period of one week of continuous work. A normal work week consists of five (5) workdays but this may be different in some workplaces, the week may consist of a variable different number of days or several shifts per day. This will have to be taken into account during statistical analysis. It is possible to limit the assessment period to only a few days or even a representative 24-hour period, however this will result in an audit that is less precise than one conducted over a one-week period. Nonetheless, this short period can still provide a glimpse of the building's performance.

Once the sampling period and duration have been selected, all waste generated during this time must be included. Do not include waste from days outside of the sampling period nor should any waste be forgotten, for example waste generated at the end of the day. Some waste streams may have different collection schedules and cycles. Take note of these for when data is analyzed and/or extrapolated.

To be compliant with BOMA BEST, there is no minimum requirement for duration of the audit. Ensure that the sample size is not less than 10% by mass of the typical time period of operation.

- Tracking requirements:

Determine the tracking requirements appropriate to the site. In all cases, the date of collection as well as the collection stream must be recorded. In some cases, also tracking the waste material's point of origin in the building will provide a more complete picture of occupant or activity impact on the total waste generated. It also allows a more detailed analysis of the efficacy of various collection streams. The most common method for tracking waste is to label waste bags. This way, each bag has a unique profile and can be analyzed in regards to collection method, collection location and time of the day/week.

When labelling and sorting tracked waste, the following information is recommended for each bag:

- Day of collection;
- Collection location (based on function, e.g. “office”);
- Collection stream (garbage bin, recycling bin [and its sub-category, if applicable, such as recycling bin for paper, recycling bin for glass], organic bin, etc.).

This stage of the waste audit is generally carried out by the building’s custodial staff. It is important to ensure that all employees involved in waste collection understand their task. A lack of rigour among staff can compromise the audit. Labels can also be placed in advance at the various collection points so that employees collecting waste can affix them to garbage bags and bins.

An effective way of validating the work of employees charged with waste collection is to place “markers” in certain bags. These markers, easily identifiable by colour and shape, can then be readily retrieved during sorting. In doing so, it becomes easy to check that bags are being labelled appropriately and in the case where they are not, adjustments can be made.

- Records:

Determine how reliable records will be obtained for each of the materials included in the scope. This is especially important for materials that are not collected through the regular collection points (such as hazardous materials, durable goods, wood pallets, etc.). Materials diverted through tenant-led initiatives (e.g. paper shredding) should be included in the audit (and consequently the diversion rate calculation) if the landlord is actively supportive of the initiative (i.e. providing resources to assist).

- Ensuring reliability:

The auditor should confirm that the sampling period for the audit will not have any changes in operations that will significantly affect the quantity or composition of the waste sample. Any anomalies encountered or suspected should be confirmed and recorded in the audit report.

- Communicating the plan:

Detailed instructions should be supplied to the building team in advance through a written communique and/or an opening meeting. Ensure instructions are supplied to any contractors that are involved with solid waste, such as maintenance contractors or night cleaning staff. Outbound waste containers should be locked or taken out of use for this period.

iii. Audit objective

The key objective of an audit is to verify annual service reports and diversion claims. It is the key document upon which is based, and which supports, future management decisions.

The audit objective may also include additional information that the client wishes to learn through the audit process.

iv. Audit criteria

The waste audit must be conducted to meet the requirements of the relevant municipal, provincial or federal regulation.

v. Acceptance criteria

Discuss and review what is expected in terms of process for staging the audit as well as acceptable levels of contamination for all materials reused, recycled and disposed. If commingling of recycled materials is performed, discuss the implications here.

vi. Other

Best practices also recommend that the plan include identification of the audit team; description of the audit report's content, timetable for activities and other information such as confidentiality requirements.

3.3. Prepare sampling area

Identify a sample inspection area that is protected from the elements. The sample should be stored in a dry, cool (not freezing) sheltered area.

In consultation with the building's cleaning staff, the audit team leader should determine how much waste and recycling is typically generated over the sample time period. For example, if material is collected in bags, the audit team should determine an estimate of the number of bags of waste and recycling typically generated in each functional area and create labels or tags for each of these bags.

4. On-site audit activities

4.1. Qualitative activities

Through on-site interviews or a pre-audit questionnaire, auditors should obtain the following information:

- Operational days: How many days per year does the facility operate?
- Other materials: Which materials will not be included in the waste audit sample? Obtain records for these. For example, temporary bins or materials sent out for external reuse.
- A profile of each solid waste stream generated:
    - The name of the material, product or waste stream. (E.g. fine paper, PET drink containers, glass, etc.)
    - A description of how the waste is generated.
    - A description of the management decisions and policies that affect the generation of this material.
    - A description of the acceptance criteria for this stream.
    - A description of the source separation program for this stream.

  - Determination if the waste stream is divertible in current viable markets and a related explanation if the material is deemed not divertible.
- Reused and Recycled Content: Can the organization demonstrate that it considers reduction, re-use and recycled content options in the products and materials it uses internally? Describe how the organization uses products and materials that consist of reused or recycled content, and describe the rationale behind the organization's choice of these products and materials.
- Base Year: What is the base year for the waste audit? The base year is the first year that a waste audit was conducted and/or the year being used for benchmark comparison purposes. (Obtain a copy of the base year audit summary and the most recent audit summary, if applicable.) If this is the first year a waste audit is being conducted, then this should be considered the base year.
- Other inspections, audits and assessments: What was the date of the most recent physical waste inspection?
- Waste Generation Index: Define the measurable per unit indicator for the facility that is most closely related to solid waste generation. For example, for a manufacturing facility, the number of production units per annum.
  - What was the per unit waste generation index of the facility for this year?
  - What was the per unit waste generation index last year?
- Related regulatory permit requirements and assurances each and any reuse, recycling and waste handler in the disposition chain. Obtain copies of Certificates of Approval and/or equivalent assurances.
- Identification of the chain of disposition of each waste stream (i.e. from a letter from the hauler):
  - The first location, processor name and phone number through to the final location, processor name and phone number.
  - A description of the method of final disposition and end market for the material should be recorded.

4.2. Data analysis

During this stage of the audit, all of the collected waste is brought to a specific location to be weighed and sorted. This can be performed in waste storage areas, spaces protected from the elements, a sorting centre or even a mobile unit, depending on the particular needs of the building and scope of the audit. Odours and sorting activities should not interfere with normal building operations. The site must be equipped with a minimum number of work tables, precise scales (+/- 0.5 lbs) and mobile containers for weighing the waste. Employees doing the sorting must also wear protective equipment adapted to the task (puncture resistant gloves, safety glasses, steel-toed footwear, long sleeve/cover all suits, face mask and a first aid kit within reach).

In order to obtain precise data, the waste must be weighed according to the collection date, location and stream. This information must be entered in the data record.

The building's performance will be assessed against various criteria during the analysis stage.

The analysis must, at the very least, establish an overall picture of the building's performance by providing a summary of waste generated for each of the different measured sub-categories (a and b), the resulting diversion rate (c) and the capture rate (d). The summary must contain an estimate of the total amount of waste generated. Appendix 3 provides a sample analysis with results.

i. Mass of all waste materials

Determine the mass of all waste materials and the corresponding destination. This should be calculated for each category waste stream (i.e. cardboard, fine paper, steel) and each method of disposition (reuse, recycle, and disposal). This is done using the annualization method enabling a calculation of the mass of materials generated for an entire year based on any sample size.

In the formulae describing annualization methods, the following variables are used:

- **T*s*** is the total material generated in a specific category found in the audit sample.
- **T*c*** is the total mass of all materials found in the audit sample with a specific method of disposition (reuse or recycling or disposal.) For materials analyzed during the audit, there will likely be a different value of Tc for all materials sent for disposal, for all materials sent for reuse, and for all materials sent for recycling during the sampling period.
- **T*r*** is the annual mass per category of materials of items not found in the audit sample for which there are records or reasonable estimates. These would be materials that would not have been found in the audit sample but are a regularly generated waste stream, such as furniture or wood pallets offered for external reuse. This is quantified and substantiated by records kept by the auditee. These materials should be accounted for in the final calculation.
- **T*t*** is the total annual mass of material, substantiated by records, per container. For example, a site may have records for each haul of a 40-yard bin of waste. Therefore, Tt for this container would be the sum of the mass of all hauls that year for that container.
- **m** is the total annual mass of each material. Note that this should be calculated for each category of waste and for each method of disposition (reuse, recycling and disposal.)
- **N** is the number of operational days per year.
- **S** is the sample size measured in number of days.

a. Extrapolation method of annualization

If annual waste and recycling records are not available or are deemed inaccurate or not verifiable, and if the sample is representative (there are very few fluctuations in the day to day operations of the facility) then the extrapolation method may be used. For each material generated, the total annual mass is:

$$m = \left(\frac{N}{S}\right)(T_s) + T_r$$

b. Mass ratio method of annualization

This method is useful and preferred if the annual waste and recycling records are deemed accurate and verifiable. For each material and for each method of disposition, the total annual mass is:

$$m = \left(\frac{T_s}{T_c}\right)(T_t) + T_r$$

ii. Diversion Rate

The Diversion Rate is the proportion by mass of all waste diverted from disposal (i.e. landfill or incineration) to the total weight of all waste material generated, expressed as a percentage. This number must not include contaminated waste.

The following activities are considered diversion actions: actions to prevent waste materials from being generated, actions to reduce material generation, reuse (internal or external), source-separated recycling, composting (on-site or off-site.) Materials that are treated with thermal applications (incineration or EFW) are **not** considered diverted.

The diversion rate can be determined through various methods and combinations such as hauler records, waste audit, etc.

Determine the building's diversion rate based on the following calculation:

[**A** / (**A**+**B**)] x 100

A = Annual mass of all materials currently diverted from disposal
B = Annual mass of all materials currently sent for disposal (includes landfill, incineration and EFW)

Express the mass in metric tonnes or kilograms.

The diversion rate must be based on 12 months of data. Data cannot be older than the past three (3) years.

Only include materials for which there is an established market in the calculation.

Annual mass of all materials currently diverted from disposal includes daily generated waste, but also all other materials diverted from building activities such as e-waste, batteries, lamps, scrap metal, wood debris, etc., that may not be captured by the waste audit.

Annual mass of all materials currently sent for disposal does not include hazardous waste such as hazardous industrial waste, chemicals, PCBs, or waste that is ignitable, corrosive, reactive, pathological, leachate or radioactive. It can include construction, renovation and demolition project waste if it was also included in the waste audit.

iii. Capture Rate

The Capture Rate is the proportion by mass of all waste *currently* diverted from disposal (i.e. landfill or incineration) to the total mass of all waste material that *could have been* diverted, expressed as a

percentage. This number must not include contaminated waste. Capture rate calculations are based on all existing opportunities to divert waste materials available in your region, not just the materials collected in the building.

The following activities are considered diversion actions: actions to prevent waste materials from being generated, actions to reduce material generation, reuse (internal or external), source-separated recycling, composting (on-site or off-site.) Materials that are treated with thermal applications (incineration or EFW) are **not** considered diverted.

Determine the building's capture rate based on the following calculation:

[**A** / (**A**+**C**)] x 100

A = Annual mass of all materials *currently* diverted from disposal
C = Annual mass of all materials that *could have been* diverted from disposal, but were found in the stream headed for disposal

Express the annual mass in metric tonnes or kilograms

The capture rate must be based on 12 months of data. Data cannot be older than the past three (3) years.

Only include materials for which there is an established market in the calculation.

Annual mass of all materials currently diverted from disposal includes daily generated waste, but also all other materials diverted from building activities such as e-waste, batteries, lamps, scrap metal, wood debris, etc., that may not be captured by the waste audit.

Annual mass of all materials that could have been diverted from disposal includes the same as the above however these materials were found in the stream headed for disposal.

iv. Contamination Rate

The Contamination Rate is the proportion of materials found in waste stream in which that material does not belong (e.g. organic material in the recycling bin).

v. Waste Reduction Year-Over-Year Change in Waste Generation (ΔP)

Ic is the waste generation index for the current year (for example, for a school, this year's enrolment.)

Ip is the waste generation index for the previous year (for example, last year's enrolment.)

Ac is the annual waste generation per unit for the current year.

$$A_c = \frac{total\ mass\ of\ all\ materials\ generated\ in\ the\ current\ year}{I_c}$$

Ap is the annual waste generation per unit for the previous year.

$$A_p = \frac{total\ mass\ of\ all\ materials\ generated\ in\ the\ previous\ year}{I_p}$$

ΔP is the change in waste generation per unit, year-over- year. *A negative result is desirable, and means that waste per unit has decreased.*

$$\triangle P = (-1)(A_p - A_c)$$

% ΔP is the percentage change per unit year-over-year comparison.

$$\% \triangle P = \frac{(-1)(A_p - A_c)}{A_p} \times 100\%$$

4.3. Data Validity

Given that the data collected during the audit is precise, the analysis conducted must also be precise. The validity of the data collected can be established in two ways: statistical validity and qualitative validity.

- Statistical validity is expressed by a margin of error, determined by simple statistical tests. Identifying an acceptable margin of error allows for a more nuanced understanding of the variations that might occur across audits over the years. As long as the differences don't ever fall outside of this acceptable margin of error it becomes possible to determine trends as opposed to using the data simply as final result.
- Qualitative validity depends on the audit team using a rigorous approach when carrying out the audit, in compliance with the established methodology. Incidents or events that occur during the audit, and that might distort results, must appear in the report, as well as the measures taken to remedy the situation.

5. Post-audit activities

5.1. Audit Report

The audit report must address the amount, nature and composition of the waste; the manner by which the waste is generated including management decisions and policies that relate to the generation of waste; and the way in which the waste is managed.

Audit reports must include:

- A description of the waste management program currently in place;
- Details about the methodology and sampling protocol used;

- A summary of the auditing procedure, including particular events in the building that might influence the data;
- A description of the different sections of the building and the waste categories that were used to classify the data and to produce a summary;
- The sample size;
- The sample date; and
- The method of annualization.

Audit reports should also include:

- Highlights of observations (annotated and/or photographs);
- Qualitative findings;
- Quantitative findings;
- Recommendations (if in the scope of the audit);
- Waste Reduction Work Plan; and
- Waste audit summary forms or equivalent in in accordance with municipal, provincial and federal regulations.

The recommendations should focus on specific measures that could improve performance, such as:

- the type of containers or bins best suited to the specific needs of the building;
- the optimal placement and number of collection containers;
- establishment of a recycling program for major waste streams generated;
- reuse and reduction options for base building daily waste (e.g. disposable dishes and coffee cups);
- information and documents on the recycling program (if any) distributed to building occupants; and
- an economic analysis of the proposed recommendations.

The report must also include a description of any anomalies and a statement of sampling limitations. The auditor should confirm that the sampling period for the audit did not have any changes in operations which would have significantly affected the quantity or composition of the waste sample.

Copies of waste, recycling, reuse, scale verification and calibration records may be included in an appendix.

The audit report must also include a waste reduction work plan and the related summary forms or equivalent in accordance with relevant municipal, provincial and federal regulation.

6. Observations

Building managers must cope with ever higher standards in regards to management of waste, which includes managing the costs of collection and processing, complying with regulations, and sorting waste. Better knowledge about the waste generated is increasingly necessary. Unfortunately, existing waste collection systems make it difficult to obtain precise data.

The reliability of audit data depends mainly on the methodology employed and its application throughout the process. The building manager must be especially vigilant regarding the audit, whether conducted in-house or by an outside professional.

By applying the recommendations in this guide, the building manager will be able to produce a waste audit report that will facilitate decision-making and will also meet the requirements of BOMA BEST certification.

APPENDIX 1: GLOSSARY

Annualization Factor: The ratio of the number of operating days at the site to the sample size in days.

Annualize: To calculate the mass of materials generated for an entire year based on any sample size.

Audit Team Leader: An auditor who, in addition to his or her role as an auditor, has the capability, authority and responsibility to lead the audit activities.

Auditee: The site being audited.

Auditor: A member of the audit team with the capability and responsibility to objectively obtain audit evidence and compare the evidence against the criteria.

Capture Rate: The proportion of divertible waste, expressed as a percentage, which is successfully diverted from disposal.

Composition: Composition is the type (e.g. #6 plastic) and the nature (e.g. yogurt container) of each waste. Appendix 2 summarizes the different categories and sub-categories of composition described in the **waste audit**.

Construction/Renovation/Demolition (CRD) waste: Any non-contaminated material in a solid state that is the result of the construction, renovation or demolition of buildings, bridges, roads or other structures. This category does not include: waste that has become unrecognizable due to burning, grinding, shredding or other processes; paints, solvents, sealers, glues or other similar materials; household rubbish; treated wood; plant and vegetable waste or any waste whose asbestos concentration is equal to or greater than 1% of its weight and likely to be dispersed in the air.

Daily waste: Materials come from everyday single-use or limited consumer products and include paper, packaging, food waste, plastics, containers, etc.

Disposal: Landfilling, incineration, gasification, pyrolysis, plasma arc treatment or another method of thermal treatment, or by deposit at a dump that does not include the handling, storing, transferring, treating or processing of waste at the dump.

Diversion: The following activities are considered diversion actions: actions to prevent waste materials from being generated, actions to reduce material generation, reuse (internal or external,) source-separated recycling, composting (on-site or off-site.)

Diversion rate: The proportion by mass of all waste diverted from disposal (i.e. landfill or incineration) to the total mass of all waste material generated, expressed as a percentage.

Durable goods: This category consists of equipment, tools and objects that have a longer life cycle, such as furniture, appliances, electrical equipment, computers, electronics, etc. They are often disposed of separately from daily waste.

Extrapolation Method of Annualization: Estimating the annual mass by extending the sample findings to an annual rate by multiplying an annualization factor.

Final disposition: The final destination in the downstream flow of materials where the processed material is to be used as a feedstock or raw material in a manufacturing process or ends up in the disposal stream. With respect to reused items, the disposition chain ends when the material fully changes ownership with confirmation that all parts of the item are being reused.

Hazardous materials: Hazardous materials include batteries, fluorescent light tubes, ballasts and chemical products, paints and solvents containers, refrigerants, cleaning agents, motor oil and propane cylinders. This type of waste is subject to special methods of disposal, dependant on the applicable rules and regulations. Hazardous materials should never be placed into the regular disposal receptacles, but should instead be recovered by specialized firms that will recycle or properly dispose of the material.

Mass Ratio: The ratio of a specific material found in an audit sample to the total sample size, by mass.

Mass Ratio Method of Annualization: A method of annualization of findings by applying the mass ratio of each material to the total mass of material generated that year.

Net Weight: The net weight of an item is equal to the gross weight (total weight) subtracted by the tare weight (container weight.)

North American Industry Classification System (NAICS): The six-digit code corresponding to the establishment's industry classification according to Statistics Canada.

Per unit reduction: The amount of waste reduced per unit, compared to last year's waste generated per unit (see Waste Generation Index.)

Point-of-generation Waste Audit: A solid waste audit that classifies the specific origin of the waste in a facility though coding, bag-labelling, or other identification methods.

Rate of contamination: Proportion of waste found in a means of collection not suitable for the waste in question.

Residual Waste: Waste that cannot be realistically diverted from disposal with the available recycling facility in the region.

Sample size: Percentage of total waste collected during an audit that is fully sorted by sub-categories and weighed to determine its exact composition. The composition of the sample is then reported to the total volume of waste and used to determine the weight of each component generated annually. Sample size can vary from 10% to 100% depending on the volume of waste generated, the duration of sampling, the site specification and the waste audit purposes.

Site: One property, including nearby properties owned or leased by the same person where passage from one property to another involves crossing, but not travelling along, a public highway.

Tare: The allowance or deduction from the gross mass of materials in a container to allow for the mass of the container. It is used to calculate the net mass of a material without removing the material from its container.

Waste: (1) Any solid or liquid waste resulting from a process of production, transformation or use; any material, substance or product that has been abandoned or slated for disposal.

(2) Encompassing term used for materials that are no longer wanted or needed and are disposed of either through landfill, reuse off-site, or recycling. Waste includes all garbage and recycling/reuse materials that are removed from the site.

Waste Audit: A study relating to solid non-hazardous wastes generated by the auditee site through regular, day-to-day operations. The audit must address the amount, nature and composition of the waste; the manner by which the waste is generated, including management decisions and policies that relate to the generation of waste; and the way in which the waste is managed.

Waste Generation Index: The waste generation index is the unit most closely related to the amount of solid waste generated by the facility such as production units or building population. The index allows effective comparison of waste generation for the building over time by "normalizing" internal fluctuations such as whether business performance or employee numbers vary.

Waste stream: A waste stream refers to the flow of a group of materials from the generation on-site, as placed in the designated waste or recycling bin by the occupants, through to the Final Disposition.

APPENDIX 2: SUB-CATEGORIES OF WASTE

Different categories and sub-categories of waste can be used in the audit. The table below provides examples of materials in each waste category; please note that this table is not complete. There may be some discrepancies in regards to what can and cannot be recycled in some jurisdictions.

Daily Waste	Durable Goods Waste	CRD Waste	Hazardous Materials

• Aluminum containers
  ○ Refundable containers
  ○ Non-refundable containers
• Cardboard boxes and cartons
• Ferrous metals
• Glass containers
  ○ Refundable containers
  ○ Non-refundable containers
• Other recyclable materials
  ○ Objects composed of many recyclable materials
• Organics
  ○ Coffee grounds and tea bags
  ○ Green waste/Gardening waste
  ○ Paper towels
  ○ Pet waste
  ○ Starch-based biodegradable containers, utensils and bags
  ○ Table scraps
  ○ Wooden stir sticks/chopsticks
• Hazardous material
  ○ Batteries
  ○ Electronics
  ○ Fluorescents/compact
	• Air conditioners, ventilators, auxiliary heaters
	• Appliances
	• Electronics
	  ○ Cell phones
	  ○ Television sets
	  ○ Computers
	  ○ Monitors and screens
	  ○ Cables
	• Furniture
	  ○ Office furniture
	  ○ Partitions
	  ○ Shelving, filing cabinets, bookcases
		• Asphalt
		• Asphalt shingles
		• Brick
		• Cables and wiring
		• Carpeting and floor coverings
		• Cardboard boxes
		• Cement
		• Construction lumber
		• Engineered wood
		• Insulation materials
		• Metal
		• Packaging
		• Plasterboard/ gypsum/drywall
		• Stone
		• Wood/lumber
			• Chemical products
			• Explosive material
			• Combustive material
			• Oil and gas products
			• Pesticides
			• Pressurized containers (propane, butane, etc.)
			• Products containing asbestos or PCBs
			• Unwashed containers of dangerous products

bulbs ○ Ink/Toner cartridges • Packaging ○ Aseptic packaging (laminated containers) ○ Bubble wrap ○ Coffee Pods ○ Food wrapping paper ○ Plastic bags ○ Plastic film ○ Packaging wrap • Paper ○ Magazines ○ Newspapers ○ Office stationery ○ Paper cups for water and coffee ○ Paper towels/hand towels ○ Shredded paper ○ Wrapping paper / Kraft paper • Plastic containers – refundable/recyclable ○ PET #1 ○ HDPE #2 ○ PVC #3 ○ PEbd #4 ○ PP #5 ○ Others #7 • Plastic containers – non-recyclable ○ Polystyrene for food products (#6 plastic) ○ Protective polystyrene (#6 plastic) • Residual waste			

APPENDIX 3: EXAMPLE OF BASIC STATISTICAL ANALYSIS

A company carries out a basic audit of waste over a 5-day period. The company wants to have an idea of its general profile, to target shortcomings and set up a recycling awareness program, and to reduce its waste collecting and management costs. No program for collecting organic waste is in place, and very little has been done in regards to creating awareness for waste separation.

The waste is collected in three ways: in trash cans, in multi-material bins (plastic, glass, and metal or PGM) and in containers for paper and cardboard only.

In this example, paper and cardboard placed in multi-material bins creates contamination, as do recyclable materials placed in a paper recycling bin.

Waste is separated into the following sub-categories for the purposes of an audit:

- Paper and cardboard
- Recyclable plastic (1,2,3,4,5,7,8)
- Metals and aluminum
- Glass
- Non-recyclable plastic (#6, materials composed of several plastics)
- Organic materials
- Paper towels
- Other materials – Ultimate Waste
- Hazardous materials.

The overall results can be presented in the form of a simple graph that allows the company to make various calculations and to achieve a profile of the building. The presentation format (shape, colour, arrangement, and demographics) is specific to each auditor.

Below is an example of results from a waste audit.

		Method of Collection																	
		Monday			Tuesday			Wednesday			Thursday			Friday			Sum			
		Trash can	Recycling of paper and cardboard	Recycling of composite materials	Trash can	Recycling of paper and cardboard	Recycling of composite materials	Trash can	Recycling of paper and cardboard	Recycling of composite materials	Trash can	Recycling of paper and cardboard	Recycling of composite materials	Trash can	Recycling of paper and cardboard	Recycling of composite materials	Trash can	Recycling of paper and cardboard	Recycling of composite materials	Sum (Kg)
WM (Kg)	Paper and cardboard	8,7	84,6	15,2	8,3	65,4	10,5	6,1	54,2	15,3	10,4	56,4	6,4	8,4	61,1	7,4	**41,9**	**321,7**	**54,8**	**418,4**
	Recyclable plastic (1,2,3,4,5,7,8)	32,4	0,5	15,4	24,5	0,0	20,4	20,8	0,5	26,4	25,4	0,7	30,1	21,4	0,0	26,4	**124,5**	**1,7**	**118,7**	**244,9**
	Metals and aluminum	3,2	0,0	4,8	2,1	0,0	5,4	1,1	0,0	4,8	0,5	0,0	8,4	1,9	0,5	12,4	**8,8**	**0,5**	**35,8**	**45,1**
	Glass	2,3	0,0	8,7	1,4	0,0	4,5	2,0	0,0	5,4	0,0	0,0	6,5	0,5	0,0	8,4	**6,2**	**0,0**	**33,5**	**39,7**
	Non-recyclable plastic (6, composites)	5,4	0,5	12,4	4,1	0,5	8,4	5,4	1,2	4,7	5,4	0,0	2,4	8,4	0,0	3,4	**28,7**	**2,2**	**31,3**	**62,2**
	Organic matter	54,6	0,0	0,5	61,4	0,0	0,0	87,4	0,0	0,0	64,1	0,0	0,0	34,1	0,0	0,0	**301,6**	**0,0**	**0,5**	**302,1**
	Paper towels	35,4	1,2	0,0	41,4	0,5	0,5	39,4	0,0	0,7	40,8	1,2	0,3	39,1	2,0	1,4	**196,1**	**4,9**	**2,9**	**203,9**
	Other materials	34,1	5,4	4,5	54,2	2,4	1,8	34,5	0,4	2,5	39,4	0,0	2,3	42,4	3,2	4,5	**204,6**	**11,4**	**15,5**	**231,5**
	Dangerous waste materials (batteries, fluocompacts, harmful chemicals)	2,5	0,0	1,2	3,6	0,0	0,5	4,5	0,0	0,6	3,5	0,0	0,0	4,1	0,0	0,5	**18,2**	**0,0**	**2,8**	**21,0**
	Sum (Kg)	**178,6**	**92,2**	**62,7**	**201**	**68,8**	**52**	**201**	**56,3**	**60,4**	**190**	**58,3**	**56,4**	**160**	**66,8**	**64,4**	**930,6**	**342,4**	**295,8**	**1568,8**

These results can be used to calculate the different rates and to analyze the building's profile.

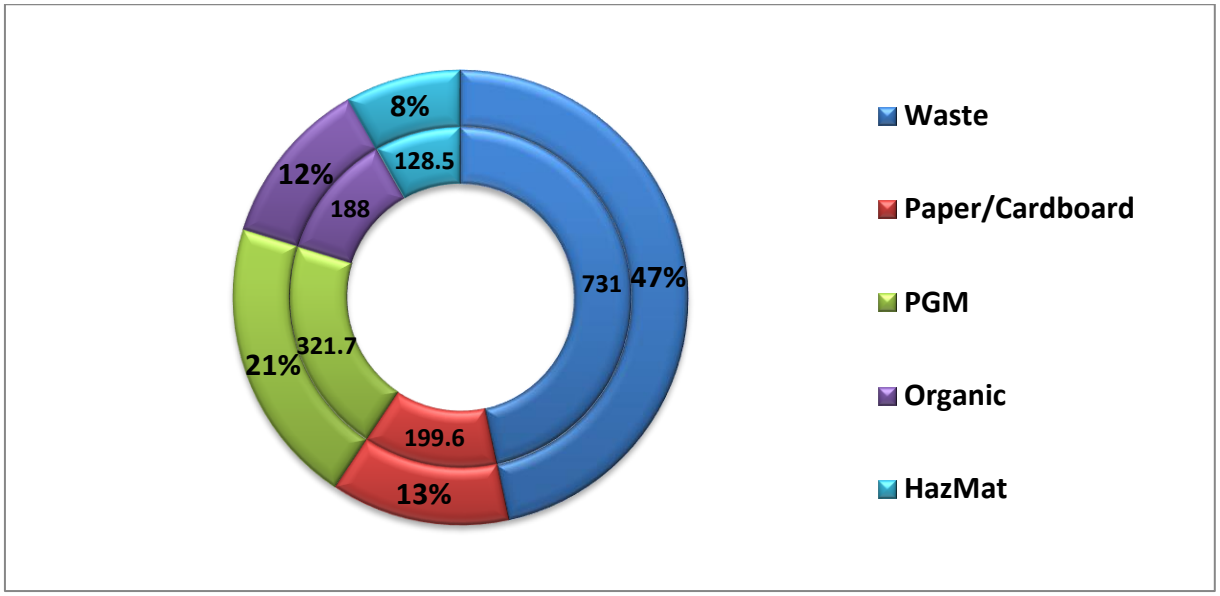
Hazardous materials by definition contaminate waste regardless of the means of collection, for they can never be discarded like regular waste.

In light of the analysis, if employees place waste in the appropriate collection bin, the overall diversion rate could go from 32.5% to 47.0%, without establishing new recycling programs. A simple program to raise awareness about the different means of collection would correct that shortcoming.

Total waste:	**1568,8 Kg**
Total volume sent to trash cans:	**930,6 Kg**
Recyclable material sent to trash cans:	181.4 Kg
Hazardous materials sent to trash cans:	18.2 Kg
Compostable material sent to trash cans:	497.7 Kg
Other materials sent to trash cans:	731 Kg
Contamination rate (trash cans):	21.4%
Recovery rate (trash cans):	**91.4%**
Volume of recycled paper and cardboard:	**321.7 Kg**
Contamination:	20.7 Kg
Contamination rate (paper and cardboard):	6.4%
Recovery rate (paper and cardboard):	**76.8%**
Volume of recycled composite material:	**188 Kg**
Contamination:	107.8 Kg
Contamination rate (composite material):	36.4%
Recovery rate (composite material):	**57.0%**
Total recycled material:	509.7 Kg
Overall diversion rate:	**32.5%**
Total contamination of recyclables:	128.5 Kg
Contamination rate of recycled material:	25.2%
Total recyclable material produced:	748.1 Kg
Real potential diversion rate:	**47.0%**
Material that could be diverted if a recovery program for organic materials were implemented:	506 Kg
Absolute potential diversion rate:	**79.9%**

Organic waste (organic materials and paper towels) could be collected by a specialized company or used internally to create compost. That would allow the absolute potential diversion rate to climb up to 79.9%. Some materials, such as objects made of composite materials and #6 plastics are often placed in the trash because no local recycling program exists (residual waste). If that is the case, the best approach is to reduce their use or improve reuse.

General Profile of Waste Collection (% and kg)



Breakdown of Waste Collected (% and kg)