

A Guide to Waste Audits and Reduction Workplans for Construction and Demolition Projects

As Required Under Ontario Regulation 102/94.



Ministry of Environment and Energy

To obtain copies of this or other guides to the 3Rs Regulations, telephone, write or fax:

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The ministry welcomes comments on the guides. Please submit them to the above address.

Questions regarding the regulations should be directed to the ministry's Waste Reduction Office in Toronto at (416) 325-4440, or to a Ministry of Environment and Energy Regional or District Office listed in Appendix A.

Copies of Regulation 102/94 are available from Publications Ontario at 1-800-668-9938 or 326-5300 in Toronto.

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PREFACE

This guide is one of a series to help waste generators, packagers, municipalities and recycling site operators understand and comply with the requirements of the 3Rs Regulations that became law March 3, 1994.

The regulations are an integral part of Ontario's Waste Reduction Action Plan, announced in February 1991 by the Minister of Environment and Energy. The plan is aimed at reducing the amount of waste going to disposal by at least 50 per cent by the year 2000 compared to the base year of 1987.

Ontario will achieve this goal with a strategy based on the 3Rs — reduction, reuse and recycling.

The 3Rs Regulations are designed to ensure that industrial, commercial and institutional (IC&I) sectors, as well as municipalities, develop programs to reduce the amount of valuable resources going to disposal.

The five new regulations, made under the Environmental Protection Act, are:

Ontario Regulation 101/94: Recycling and Composting of Municipal Waste

Ontario Regulation 102/94: Waste Audits and Waste Reduction Workplans

Ontario Regulation 103/94: Industrial, Commercial and Institutional
Source Separation Programs

Ontario Regulation 104/94: Packaging Audits and Packaging Reduction
Workplans

Ontario Regulation 105/94: Definitions (Amendments to Regulation 347)

This guide will help those undertaking construction or demolition projects comply with the requirements for conducting waste audits and preparing and implementing waste reduction workplans as required under Regulation 102/94. For a legal interpretation of requirements, refer to the Official Regulation.

The other guides in this series are:

- # *A Guide to Source Separation of Recyclable Material and Leaf and Yard Waste Systems for Municipalities as Required under Ontario Regulation 101/94*
- # *A Guide to Source Separation of Recyclable Material for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings as Required under Ontario Regulation 103/94*
- # *A Guide to Approvals for Recycling Sites, Leaf and Yard Waste Composting Sites and Compost Use as Required under Ontario Regulation 101/94*
- # *A Guide to Waste Audits and Reduction Workplans for Industrial, Commercial and Institutional Sectors as Required under Ontario Regulation 102/94*
- # *A Guide to Packaging Audits and Reduction Workplans as Required under Ontario Regulation 104/94*

Ontario's Waste Reduction Target

The Government of Ontario has established a target to decrease the amount of waste going to disposal by at least 50 per cent by the year 2000 compared to the base year of 1987. This is a *provincial* target that applies to the total amount of non-hazardous solid waste generated in Ontario from all sources.

While this target is not a legal requirement for individual municipalities and IC&I establishments under the 3Rs Regulations, many have voluntarily adopted it, and some have set an even higher waste reduction target.

TABLE OF CONTENTS

1.0 Introduction	1
1.1 Compliance Deadlines	2
2.0 General Requirements	3
2.1 Conducting a Waste Audit	3
2.2 Developing a Waste Reduction Workplan	3
2.3 Implementing a Waste Reduction Workplan	4
2.4 Processing and Reporting Requirements	4
3.0 Who is Affected / Special Provisions	5
3.1 Construction Projects	6
3.2 Demolition Projects	6
Appendices	
A Ministry of Environment and Energy Offices	7
B A Typical Waste Reduction Program	8
C Additional Sources of Information	27
D Conversion Factors	29
Forms	
Waste Audit Summary	
Waste Reduction Workplan Summary	

1.0

INTRODUCTION

The 3Rs Regulations apply to all non-hazardous solid wastes from residential and industrial, commercial and institutional (IC&I) sources. This guide focuses on the requirements for waste audits and workplans specific to the construction and demolition industry.

The development and implementation of waste audits and waste reduction workplans by those construction and demolition projects designated under Regulation 102/94 will contribute significantly to the province's waste reduction goal.

IC&I wastes, including those generated by the construction and demolition industry, make up the largest component of the non-hazardous solid waste stream. Efforts in these sectors to reduce waste will, therefore, have the greatest potential for diverting materials away from disposal into productive use.

Waste audits and waste reduction workplans can also help reduce the residential waste stream. Changes in the manufacturing process, for example, identified by a waste audit, can lead to design changes in the product ultimately bought by consumers. The design changes may incorporate the 3Rs hierarchy by reducing material use and by making the product more reusable or recyclable.

Chapter 1.0 of this guide provides compliance deadlines for the completion of waste audits and workplans under Regulation 102/94. Chapter 2.0 describes the general requirements of a waste reduction program. Chapter 3.0 defines the construction and demolition projects that must implement a waste reduction program and any special provisions which apply to these projects.

The appendices list information sources for obtaining assistance on implementing a waste audit and reduction program and sample forms required for recording purposes. Appendix B contains information on a typical waste audit process and checklists for 3Rs activities which may be useful in preparing a waste reduction workplan.

1.1 Compliance Deadlines

Regulation 102/94 provides a six-month transition period for construction and demolition projects that began before the regulation came into force on March 3, 1994. The compliance rules for existing projects are as follows:

- # Existing projects must comply before September 3, 1994, the end of the six-month transition period.
- # Existing projects need not comply if all site work is completed before September 3, 1994.
- # Existing projects still in operation after September 3, 1994 must conduct a waste audit but the audit needs to consider only waste generated after September 3, 1994.

Designated construction or demolition projects started after March 3, 1994 have until September 3, 1994 to complete a waste audit and a waste reduction workplan.

After September 3, 1994, designated construction and demolition projects must prepare a waste audit and reduction workplan before work begins at the site.

2.0

GENERAL REQUIREMENTS

A waste reduction program for construction and demolition projects required under Regulation 102/94 has three basic components:

1. Conducting a waste audit
2. Developing a waste reduction workplan
3. Implementing the workplan

This chapter outlines the requirements for these components and the reporting process.

2.1 *Conducting a Waste Audit*

A waste audit is essentially a study relating to waste generated by a project. A waste audit involves more than simply measuring or estimating the quantity and composition of waste that will be generated. It must also look at the underlying reasons for waste generation and the operational factors which contribute to the waste.

Under the regulation, all waste audits must address:

- # the amount, nature and composition of the waste generated;
- # how the waste is produced, including any management policies and practices that relate to the production of waste; and
- # how the waste is managed.

Regulation 102/94 requires that the audit be completed before work is started at the site. This means that a waste audit for a project will need to be done in conjunction with, and based on, other planning activities related to the project.

2.2 *Developing a Waste Reduction Workplan*

The information resulting from the waste audit forms the basis for developing the waste reduction workplan. The workplan addresses 3Rs opportunities which will be pursued.

Regulation 102/94 requires that all completed waste reduction workplans must include all reasonable actions that can be taken. These actions must follow the 3Rs hierarchy, with reduction as the first priority, followed by reuse and then recycling.

2.3 Implementing a Waste Reduction Workplan

Regulation 102/94 requires that a workplan be developed before work starts at the site (see 1.1 for information on deadlines). The workplan must assign responsibilities and resources, and state expected results.

A workplan may be structured so that some actions are given a higher priority than others. A number of factors may need to be considered to determine which actions will contribute most to meeting waste reduction objectives.

2.4 Processing and Reporting Requirements

Those conducting a waste audit and preparing and implementing a waste reduction workplan must include several features which document the process and results.

The requirements described below apply to all designated projects. Additional provisions which apply to either construction or demolition projects are described in Chapter 3.0.

- # A waste reduction workplan must set out who will implement each part of the plan, when each part will be implemented and what the expected results are.
- # A waste audit and waste reduction workplan must be documented in written reports.
- # A report of a waste audit or a waste reduction workplan must be on a form provided by the ministry or follow the same format. A sample form and instructions are included at the end of this guide; additional forms are available from the ministry's Regional and District Offices. In most cases, a waste audit or waste reduction workplan will include much more extensive documentation than the summary information required on these forms.
- # A report of a waste audit or a waste reduction workplan must be retained on file for at least five years.
- # A waste reduction workplan must deal with the wastes that will be generated in the designated project.
- # The waste reduction workplan or a summary of the workplan must be posted in places where workers at the site will see it. Workers must be allowed to see the workplan on request.
- # The person responsible for the designated project must submit the audit and workplan to a ministry Director within seven days if requested.

3.0

WHO IS AFFECTED / SPECIAL PROVISIONS

The requirement to prepare waste audits and waste reduction workplans applies only to persons who are designated in the regulation. All associated administrative, warehousing, or other ancillary activities/departments located on site are considered to be included.

Building floor area is the criteria used to designate construction and demolition projects. It is to be calculated as gross area according to the Ontario Building Code. Gross area, as defined in the Code, means “the total area of all floors above grade measured between the outside surfaces of exterior walls or between the outside surfaces of exterior walls and the centre line of firewalls except that, in any other occupancy than a residential occupancy, where an access or a building service penetrates a firewall, measurements shall not be taken to the centre line of such firewall.”

The area should be calculated as the total area of the building. This is the area normally reported on Building Permits. Multi-story or underground parking lot areas must be included in the total building area. However, any outside areas such as ground-level outdoor parking lots or recreation parks are not part of the total area. For example, an apartment complex project consists of three buildings, with areas of 800, 500 and 600 m², and an outdoor ground level parking lot of 1,000 m². The sum of the three building areas — 1,900 m² — would be the total area of the project and, therefore, it would not need to comply with the regulation.

A project includes the operations normally associated with the construction or demolition of buildings. Types of projects include construction or demolition of residential, commercial, industrial or institutional buildings such as single family housing, apartments, offices, factories or hospitals. Renovation projects are not designated under the regulation.

3.1 Construction Projects

A “construction project” is designated if it consists of the construction of one or more buildings with a total floor area of at least 2,000 square metres.

The waste audit must address the extent to which materials or products used by the builder consist of recycled or reused materials or products.

3.2 Demolition Projects

A “demolition project” is designated if it consists of the demolition of one or more buildings with a total floor area of at least 2,000 square metres.

All projects designated by Regulation 102/94 are also required to establish a source separation program under Regulation 103/94. See *A Guide to Source Separation of Recyclable Materials for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings*.

APPENDIX A - Ministry of Environment and Energy - Regional and District Offices

Central Region

Halton - Peel District Office
1235 Trafalgar Road, #401
Oakville, ON L6H 3P1
Tel. #: (905) 844-5747
Fax #: (905) 842-1750

Toronto Regional and York - Durham
District Offices
7 Overlea Blvd., 4th Floor
Toronto, ON M4H 1A8
Tel. #: (416) 424-3000
Fax #: (416) 325-6345

West Central

Cambridge District Office
P.O. Box 219
320 Pinebush Road
Cambridge, ON N1R 5T8
Tel. #: (519) 622-8121
Fax #: (519) 622-3119

Hamilton District Office
Box 2112
119 King St. West, 12th floor
Hamilton, ON L8N 3Z9
Tel. #: (905) 521-7650
Fax #: (905) 521-7806

Welland District Office
637-641 Niagara Street North
Welland, ON L3C 1L9
Tel. #: (905) 384-9845
Fax #: (905) 735-0574

Mid-Ontario Region

Barrie District Office
54 Cedar Point Drive, Unit 1203
Barrie, ON L4N 5R7
Tel. #: (705) 726-1730
Fax #: (705) 726-5100

Muskoka Haliburton District Office
483 Bethune Drive
Gravenhurst, ON P0C 1G0
Tel. #: (705) 687-6647
Fax #: (705) 687-3715

North Bay District Office
Northgate Plaza
1500 Fisher Street
North Bay, ON P1B 2H3
Tel. #: (705) 476-1001
Fax #: (705) 476-0207

Sudbury District Office
199 Larch Street, 11th Floor
Sudbury, ON P3E 5P9
Tel. #: (705) 675-4501
Fax #: (705) 675-4180

Southeastern Region

Belleville District Office
470 Dundas Street East
Belleville, ON K6H 1C1
Tel. #: (613) 962-9208
Fax #: (613) 962-6809

Cornwall District Office
205 Amelia Street
Cornwall, ON K6H 3P3
Tel. #: (613) 933-7402
Fax #: (613) 933-6402

Kingston District Office
133 Dalton Street
Kingston, ON K7K 6C2
Tel. #: (613) 549-4000
Fax #: (613) 548-6920

Ottawa District Office
2435 Holly Lane
Ottawa, ON K1V 7P2
Tel. #: (613) 521-3450
Fax #: (613) 521-5437

Peterborough District Office
1477 Lansdowne Street West
Peterborough, ON K9J 7M3
Tel. #: (705) 743-2972
Fax #: (705) 748-4192

Southwestern Region

London Regional Office
985 Adelaide Street South
London, ON N6E 1V3
Tel. #: (519) 661-2200
Fax #: (519) 661-1742

Owen Sound District Office
1180 - 20th Street East
Owen Sound, ON N4K 6H6
Tel. #: (519) 371-2901
Fax #: (519) 371-2905

Sarnia Area Office
265 Front Street North
Sarnia, ON N7T 7X1
Tel. #: (519) 336-4030
Fax #: (519) 336-4280

Windsor District Office
250 Windsor Avenue, 6th floor
Windsor, ON N6A 6V9
Tel. #: (519) 254-2546
Fax #: (519) 254-5894

Northern Region

Kenora District Office
P.O. Box 5150
808 Robertson Street
Kenora, ON P9N 1X9
Tel. #: (807) 468-2718
Fax #: (807) 468-2735

Sault Ste. Marie District Office
747 Queen Street
Sault Ste. Marie, ON P6A 2A8
Tel. #: (705) 949-4640
Fax #: (705) 945-6868

Thunder Bay Regional Office
P.O. Box 5000
435 James Street South, 3rd
Floor
Thunder Bay, ON P7C 5G6
Tel. #: (807) 475-1205
Fax #: (807) 475-1754

Timmins District Office
23 Algonquin Blvd. West
Timmins, ON P4N 2R4
Tel. #: (705) 268-3222
Fax #: (705) 264-7336

APPENDIX B: A TYPICAL WASTE REDUCTION PROGRAM

Getting Started

Ideally, your waste audit/reduction workplan program should be managed by a person who is interested in resource conservation and has sound knowledge and experience of your company's operations. An effective Waste Reduction Coordinator will have the greatest impact when fully involved in all aspects of the waste audit and reduction workplan program.

For larger projects, you may wish to form a Waste Reduction Committee to set up and maintain your waste reduction program. The committee could consist of the coordinator, owner, general contractor and site supervisor, representatives of various sub-trades and a waste hauler. This will allow you to generate ideas collectively and ensure that the program is designed to provide opportunities for everyone to participate. Also, by spreading information outwards, it builds a stronger awareness of your waste reduction plans.

Examples of what role(s) the coordinator/committee could play to successfully undertake a waste audit and to implement a waste reduction workplan include the following:

- # identifying and interpreting government requirements and regulations;
- # securing senior management support;
- # conducting and/or overseeing the waste audit;
- # establishing the waste reduction goals;
- # identifying funding requirements and the costs and benefits of the program;
- # developing a 3Rs program and implementation schedule;
- # monitoring the waste reduction, reuse, and recycling activities;
- # promoting and communicating waste reduction activities.

Communicating Project Objectives

Before initiating a waste audit or reduction workplan, you should inform everyone involved of the objectives of the program and the importance of their cooperation. Sub-trades should be informed also. They will need to work cooperatively to characterize and measure waste streams and effectively implement waste reduction measures.

CONDUCTING A WASTE AUDIT

Introduction

An important factor in planning your waste audit is the level of audit detail you choose to use. The level of detail depends upon the size of the project, complexity of operations, and accuracy you require for your reduction workplan.

The following waste audit process is one approach that will provide you with enough information to proceed with your waste reduction workplan and to meet the requirements of the Ministry of Environment and Energy. This approach is intended to identify the major wastes and to provide a starting point for your waste diversion initiatives. Figure 1, Waste Audit Flowchart, provides an overview of the audit process. More detailed “how to” information sources are listed in Appendix C.

Step 1: Assemble Basic Information

Review Operations

You should review and record the following basic information about your construction or demolition project:

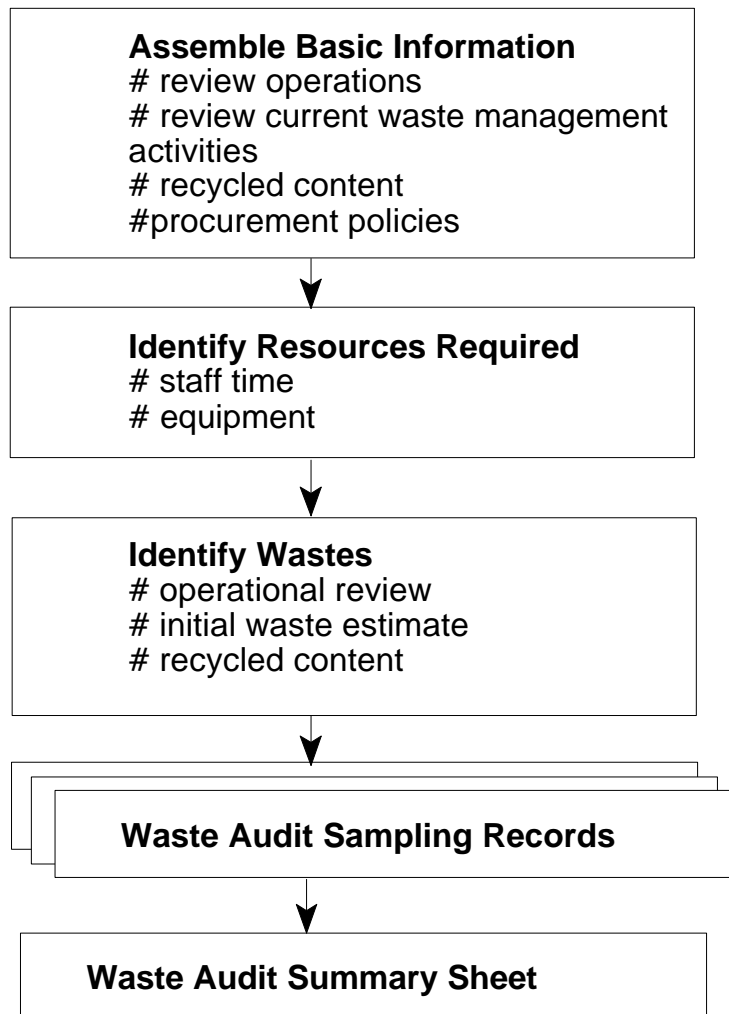
-
- # building floor area or other indicators relevant to your projects;**
 - # type and size of construction or demolition project;**
 - # location;**
 - # stages of project, e.g. excavation, structural, interior finishing;**
 - # stages of the project that are sub-contracted to trades; and**
 - # purchasing policies.**
-

It is also important to review all areas of your project so that you will not miss future opportunities for waste reduction. The scope of the review will include the traditional waste generation areas. This level of review, with waste reduction in mind, often leads to significant opportunities.

Here are the minimum points to review:

-
- # **composition and quantity of all wastes directly generated within the project through all normal activities;**
 - # **the extent to which materials or products used consist of recycled or reused materials or products;**
 - # **the manner by which the waste is generated including management decisions and policies that relate to the production of waste; and**
 - # **the way in which the waste is managed.**
-

Figure 1: Waste Audit Flowchart



Review Existing Waste Reduction and Disposal Activities

At this early point in the audit program, you should also review your current waste management activities. The review will provide start-up information for your waste audit and for later efforts in waste reduction planning.

Basic questions to be asked relate to:

-
- # waste separation and recycling activities;**
 - # timing and frequency of waste collections;**
 - # methods of waste collection to be employed, including internal and external waste handling;**
 - # quantities of waste and recyclables to be collected;**
 - # waste collection contractor/recycling service contractor;**
 - # person responsible for waste management/reduction;**
 - # responsibilities of sub-trades for their own waste disposal;**
 - # gross costs of waste collection and disposal; and**
 - # obtain an up-to-date list of recycling facilities and capabilities in your area.**
-

Step 2: Identify Wastes

The objective of this step is to estimate types of wastes and places where they will be generated. During the review, you should note collection and storage practices and any other special considerations that should be taken into account later when you develop your waste reduction workplan.

It is your responsibility to ensure that the information that appears in the audit reflects the waste which will be generated by your project.

Sources of information may include:

-
- # engineering estimates;**
 - # material purchasing records;**
 - # waste disposal invoices for similar projects;**
 - # records of waste produced at generation points in daily operations of other projects; and**
 - # studies of similar projects.**
-

You can identify your wastes by:

-
- # **Estimating wastes generated through each stage of a project based on building construction and demolition methods, materials and efficiencies. Staff and sub-trades may be required to submit information to the coordinator for summary.**
 - # **Conducting a walk-through review of operations on similar projects to ensure that all waste streams have been identified. Look inside waste containers, and, above all, ask questions.**
-

Classify your wastes as follows:

-
- # **materials that the Ministry of Environment and Energy will require you to source separate for recycling (see *A Guide to Source Separation of Recyclable Material for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings*);**
 - # **other materials identified within your project that could be source-separated for reuse or recycling;**
 - # **residual material which would go for disposal.**
-

Figure 2, Waste Sampling Record, may be used to summarize the results of this step.

Step 3: Identify Recycled Content of Building Materials

Up to this point, you will have assessed the composition, volumes, and weights of wastes generated on a project. This step requires you to examine the current reduction activities at the front end of your operations.

You should now examine purchasing specifications to identify the recycled content of purchased building products, and raw materials. This will be useful for determining whether you can take steps to increase use of items with higher recycled content.

It will not be necessary to examine 100 per cent of your incoming materials. A common approach is to combine the individual purchases of similar materials and to list them in descending order of purchase value. It is usually found that the first 20 per cent or so of the listed materials account for 80 per cent or more of the total purchase value (and potential waste). This means that you may need to examine only 20 per cent of the material types concerned to obtain most of the information you need.

Figure 2: C&D Waste Sampling Record

Location: Number 3 Office Tower - 2000 One Street			Date: October 1994	
Sample Taken: Portion of Demolition Phase			Time Period: October to Dec. 1994	
Operation Characteristics: Nothing unusual				
Material	Characteristics	Volume *	Weight (tonnes)	% of Total ** Sample
Wood	offcuts, warped pallet forms	60 cu. yd.	9	16 %
Concrete & masonry	Rubble from concrete and brick	120 cu.yd.	40	71
Plaster		30 cu.yd.	4	7
Cardboard	Packaging	2 cu.yd.	.25	.4
Drywall	Clean drywall	2 cu.yd.	.25	.4
Misc		64 cu.yd.	3	5.3
Totals		278 cu.yd.	56.5	100 %

* Please note if you measure your waste by volume, you must convert these figures to weights. See Appendix D for Conversion Table.

** If using purchasing records, calculation of % is not applicable.

Looking at the major material purchases, you can quickly review the recycled content of each material. Approach your supplier immediately if the information needed is not readily available.

Step 4: Complete Waste Audit Summary Sheet

You should maintain a record of the information reviewed, assumptions made, waste samples examined (including the sample dates) and the material weights and/or volumes calculated.

You are now ready to complete the Waste Audit Summary, Figure 3, as required by the Ministry of Environment and Energy under the regulation. A blank audit report form is provided at the end of this guide. If you wish you may use your own forms as long as their formats are similar to those provided here.

To determine if you've met your waste reduction goals, you may wish to relate waste generation to a specific indicator, so that changes in production or activity can be accounted for. For example, the size of each project will likely change from one project to the next. By calculating the total waste generated per unit floor area of the project, comparing this factor with those of other projects, you might observe whether a change in overall waste generation is due to project size, type or other factor.

Figure 3: Waste Audit Summary Form



Waste Audit Summary
Construction and Demolition Projects
As required by Ontario Regulation 102

Name of company Number 3 Office Tower	Name of contact person Joe Wasteman	Telephone No. (123) 456-7890
Project site location (if applicable) 2000 One Street, Downtown, Ontario A1B 1A1		Date of audit Oct 1, 1994
Type of project		
<input type="checkbox"/> Construction project	Square metres	<input checked="" type="checkbox"/> Demolition project
		Square metres 2,750 sq.m.

Material category	Waste generated (tonnes)	Reused material (tonnes)	Recycled material (tonnes)
Wood	1125	76	5.5
Concrete & masonry	5000	30	2005
Metal	94		70
Plaster	500		
Roofing	250		
Cardboard	31	22	
Plastic	12.5	2	
Drywall	31	7.5	23
Total	7043.5	137.5	2103.5

Materials (bought/sold) that contain recycled content	
Material	Percentage of recycled content
Cardboard	20 %
Plastic	13 %

I hereby certify that the information provided is complete and correct, and the establishment complies with all the requirements of Regulation 102.

Signature of authorized official	Title	Date
----------------------------------	-------	------

CREATING A WASTE REDUCTION WORKPLAN

Introduction

In the waste audit process you have been studying the waste generated in your project and learning more about your waste management policies and operations. Now you are ready to take action aimed at further waste reduction. Figure 4 gives an overview of an acceptable process for creating the waste reduction workplan.

Step 1: Review Current 3Rs Activities

To begin the process, review your Waste Audit Summary Sheet and assemble information relating to 3Rs actions currently in place, including:

-
- # **waste reduction policies;**
 - # **current waste reduction, reuse, recycling and disposal activities;**
 - # **types and quantities of materials in each activity;**
 - # **achievement of current waste reduction targets;**
 - # **operating cost impacts as a result of 3Rs activities.**
-

Step 2: Identify Areas of Greatest Waste Reduction Impact

A key factor in finding 3Rs opportunities for waste reduction involves examining those materials that make up a large part of the waste produced, usually by weight or volume. Such a move to organize your waste audit data will highlight areas where your reduction efforts will have the greatest impact. Waste audit data can be organized in different ways by:

-
- # **weight or volume;**
 - # **disposal cost;**
 - # **potential for source separation;**
 - # **potential to reduce, reuse or recycle;**
 - # **complexity of handling;**
 - # **current and potential regulatory requirements.**
-

Figure 4: Waste Reduction Workplan Summary

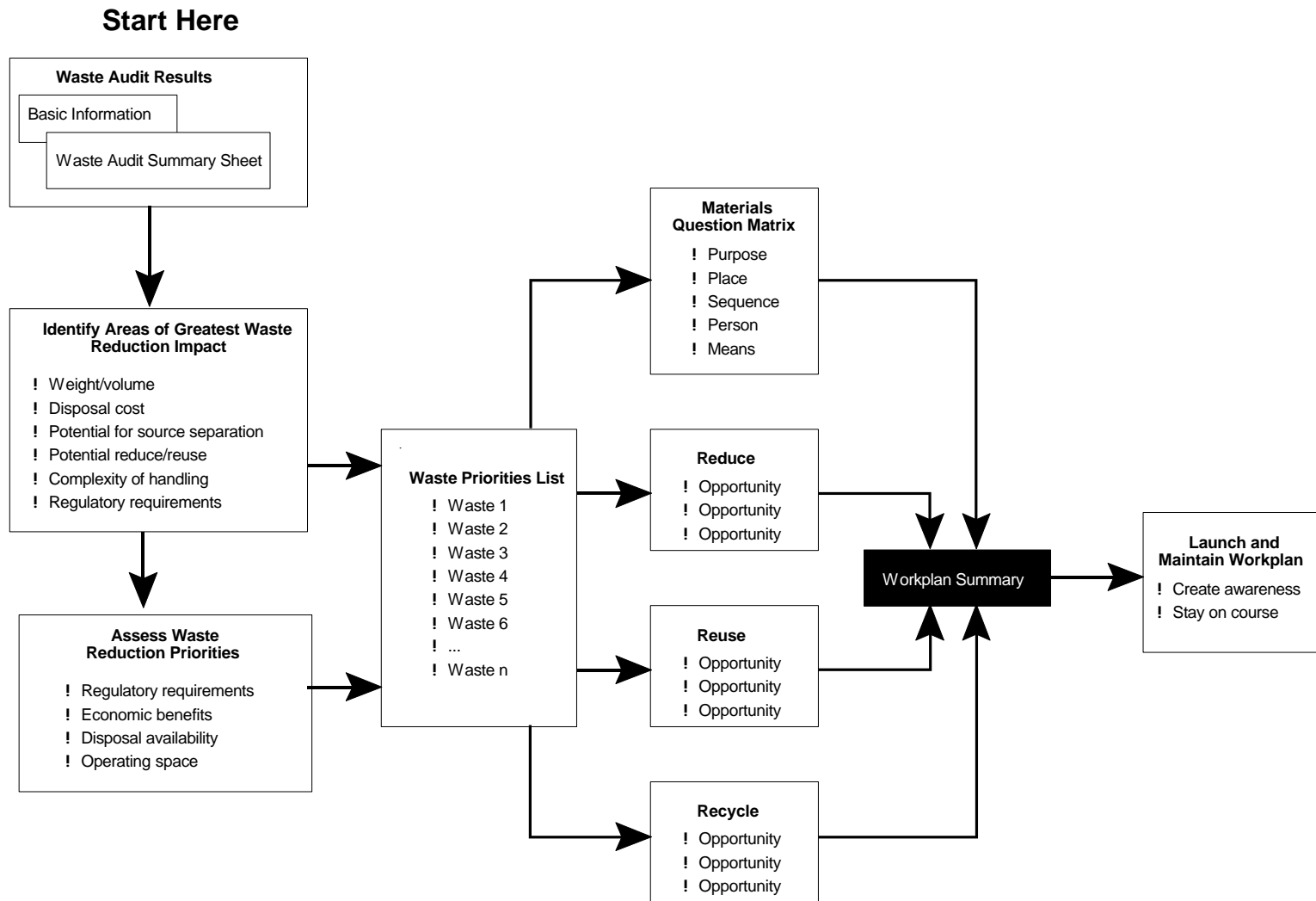


Figure 5 shows typical ways to summarize your waste material rankings.

You should also consider issues you may face in implementing 3Rs programs, including the following: health and safety regulations; storage space at your project; availability of recycling markets and collection services; and operating costs.

Step 3: Assess Waste Reduction Priorities

After identifying general areas for potential waste reduction, you should look at the possible impact of other priorities on your 3Rs options. At this point in your workplan development, you should consider at least the following items:

- # **Current and potential regulatory requirements: Check items for reduction, reuse, and recycling limitations (e.g., restrictions on wastes that may be considered “contaminated”).**
- # **Economic benefits: Review the costs and benefits of each waste reduction opportunity.**
- # **Continuing disposal availability: Be aware of planned or anticipated landfill closures or other disposal limitations that may affect your waste materials.**
- # **Changing operating space constraints: Availability of on-site storage space may not continue in the longer term.**

Any other priority influences that relate specifically to your projects should be factored into your waste reduction decisions.

Step 4: Determine Why Waste Is Generated

In assessing your waste reduction options, you should ask the following basic question at the start: “Why is this material being used?” Questions such as this can stimulate thought and help you develop many other ways of dealing with the material under review. A list of suggested questions is below:

Purpose	Why is the material being used?	What else could be used?	What should be used?
Place	Where is it used?	Where else could it be used?	Where should it be used?
Sequence	When is it used?	When could it be used elsewhere?	When should it be used?
Person	Who uses it?	Who else could use it?	Who should use it?
Means	How is it used?	How else could it be used?	How should it be used?

Figure 5: C&D Organized Waste Audit Data

Waste Material Type	Volume (cu.metre)	Weight (tonne)	Waste Costs (\$)
Wood	60	9	110.00
Concrete & masonry	120	40	40.00
Cardboard	2	.25	25.00
Drywall	2	.25	75.00
Roofing materials	25	2	150.00
Metal	10	.75	Potential revenue

Ranking by Volume		Ranking by weight		Ranking by Waste Costs	
Material Type	Volume (cu.m.)	Material Type	Weight (tonnes)	Material Type	Cost (4/tonne)
Concrete & masonry	120	Concrete & masonry	40	Metal	Potential revenue
Wood	60	Wood	9	Cardboard	25.00
Roofing materials	25	Roofing materials	2	Concrete & masonry	40.00
Metal	10	Roofing materials	.75	Drywall	75.00
Cardboard	2	Metal	.25	Wood	110.00
Drywall	2	Cardboard	.25	Roofing materials	150.00
		Drywall			

Answers to these questions may show the way to various options for reducing, reusing, and/or recycling your wastes, including:

-
- # where waste can be reduced by eliminating the use of certain product materials;
 - # where other materials can be used that, in turn, can be reused or recycled;
 - # where less wasteful materials can be used;
 - # where less material can be purchased (e.g. buying in bulk versus individually wrapped items);
 - # where previously recycled materials can be used;
 - # where controls can be set up to reduce waste generation during your operations.
-

Step 5: Identify Opportunities for Reducing, Reusing and Recycling Wastes

By now you will be focused on specific materials in terms of waste reduction opportunities and priorities. Achievement of your waste reduction goals will usually involve the cumulative effect of a number of 3Rs initiatives. This section outlines some 3Rs opportunities which are in common use. Your own situation may differ, however, and not all these possibilities will apply. In many cases the ideas are very simple yet these can often lead to more significant initiatives.

Reducing Wastes

Workers on your project may already use various methods to reduce the quantity of waste being generated. For example, you may already have replaced some disposable products with either reusable products or disposable products which can be recycled.

You should take a similar approach for each of the materials you use to support and maintain your construction/demolition projects. Focus on reducing the quantities of disposable supplies and equipment used, and on improving purchasing policies to reduce the amount of incoming packaging. You could also increase your controls over the quantities of material consumed (e.g., to reduce the amount of drywall used in your project).

State expectations in trade contracts. Expectations regarding material supply, site cleanup, and compliance with waste reduction initiatives should be clearly stated in tendering and contract documents. Establish contracts with trades to supply both labour and materials. If trades supply materials, they will be fully committed regarding usage. Alternatively, establish policies that require contractors to remove and divert waste materials from disposal.

Produce more efficient construction designs where possible. Reducing material wastage begins at the design stage. Designers, architects, and builders should evaluate their plans for efficiency of material usage (e.g., consider standardizing room sizes and minimizing off-cuts).

Use more prefabricated products. Less waste may be generated on-site if more prefabricated or pre-cut products such as floor joists, trusses, and truss-joints are used.

Purchase selected materials in bulk containers. Purchase materials such as fasteners, paint, caulking and drywall mud in bulk containers. Stored in such containers, they are not as vulnerable to weather damage.

Reduce neighbourhood contamination. Neighbourhood contamination is a common occurrence and creates many problems. Protect waste bins and piles by covering them, securing them with locks and locating them in well-lit areas. Signs stating the company's commitment to waste reduction and dumping restrictions should be posted on-site and on bins.

Reusing Wastes

A reuse strategy to avoid waste is common on construction sites. Forms for pouring foundations, scaffolding and other systems all lead to less waste. Also consider using wastes from one application on other projects. For example, aluminum sheet offcuts from one job may provide the raw material input to another, smaller job. In your own operations, you may already reuse certain materials. But, there may be others who can make beneficial use of your waste. This option can also help reduce your disposal costs.

Remove items carefully during demolition. Disassemble items carefully during demolition to minimize damage and salvage for reuse as many items as possible. Selected residual components of construction are often relatively simple to remove for reuse and will continue to have a useful lifespan.

Invite the public to reuse materials. Conduct a “strip-out sale” or advertise that certain items are free-for-the-taking by the public once they are removed from the building. Items of interest to the public may include bundles of wood off-cuts, doors, windows, decorative mouldings, cabinets, plumbing and electrical fixtures and older appliances. Consider sending materials to salvage yards for future reuse.

Collect and store reusables. Space permitting, warehouse your unused materials and salvaged items for future use or re-assembly in another project. If not, direct your reusables to your local "reuse" facility. Join other companies to collect, re-distribute, and reuse waste materials. For example, excess brick from one or several projects can be reused as part of a fireplace or chimney on another project.

Explore availability of "Off-Spec" products. Where appropriate consider using "off-spec" products such as for stairs, windows, and doors.

Reuse Items On-Site for Different Purposes. Many items have reuse potential on the job site. Reuse lumber off-cuts as bridging, blocking, or forming stakes. Recover plastic vapour barrier and wrappings and reuse as protection for tools and materials when not in use. Use cardboard boxes for temporarily storing small quantities of recyclables. Excess insulation from exterior walls can be added to interior walls or attics.

Recycling Wastes

Most construction/demolition projects can take advantage of opportunities for external recycling of wastes. Markets exist for many recyclable materials such as: steel, aluminum, corrugated cardboard, wood, drywall, concrete and glass. Other materials, such as roofing materials and fibreglass insulation, may be added to your recycling list, as the markets develop.

The economics of recycling will vary with the material. For some materials you will receive direct revenue. For others, the cost of recycling may simply be less than the cost of landfill tipping fees.

Establish a recycling program. The Ministry requires that the

construction and demolition projects identified in this guide have a recycling program in place. See A Guide to Source Separation of Recyclable Materials for the Industrial, Commercial and Institutional Sectors.

Source Separate Recyclables. Several alternatives exist to source separate recyclables. Several recycling containers and bins should be provided on every site to facilitate source separation.

Provide Adequate Training. Workers should be provided with training in source separation techniques and supplied with adequate means to perform this task efficiently.

Back-charge trades. Consider back-charging trades for the waste they generate and the additional labour hours the general contractor takes to clean it up. Workers could be instructed to record the amount of time spent to clean up each trade's waste throughout the day.

Investigate waste handling techniques and equipment. Waste handling techniques and equipment such as split-bins and split-chutes are available. They can be useful on small sites as they help to maximize use of space.

Step 6: Assess Impact of Material Purchasing on Waste Reduction

Many of your waste reduction opportunities will involve your material purchasing practices. In some cases, you may develop a purchasing policy to buy materials that already have a recycled content. This action has the added benefit of improving the overall market for recycled materials.

Actions to change the material used in construction may involve discussions with your suppliers. For other products, you can work with your supplier to provide you with more “environmentally sound” materials. Replacing non-recyclable materials with reusable or recyclable materials gives economic benefits as well as greater waste diversion.

Another important waste reduction action with suppliers involves reducing packaging and containers. Many companies, as part of their purchasing and materials management policies, set up distribution systems with their suppliers to use returnable transportation/storage containers. Working with suppliers, you can eliminate many of the inspection and interim storage processes that require higher material/packaging volumes and the associated administrative paperwork.

On a general basis, you should also review the materials and products currently purchased from your supplier to ensure optimum “environmental

friendliness”. This will increase your level of reliance on your suppliers to advise your company on the availability of previously recycled or more easily recyclable materials for your own use.

Step 7: Complete an Achievable Waste Reduction Workplan

Your waste reduction workplan is a compilation of the waste reduction opportunities you have identified and the actions you intend to take in reducing your wastes. At this stage you should also set waste reduction targets. The provincial target is at least 50 per cent reduction by 2000. Ideally, you should be attempting to meet if not exceed this target.

Try to set realistic reduction targets; it is important that your workplan is achievable.

Your targets will form the basis for waste reduction actions for each waste material. These decisions reflect the benefits of accurate waste audit information. Missed targets could have negative impacts on your workers attitudes and confidence in future waste reduction workplans.

Figure 6 shows a completed Waste Reduction Workplan Summary. This format is designed to complement the Waste Audit Summary Report. The workplan focuses on the wastes for which reduction actions have been identified and reduction targets set. The format allows actions on separate waste materials to be identified as well as the total amounts of waste reduced, reused, and/or recycled.

The Waste Reduction Workplan Summary is a two part form with the general company information at the top and the materials, actions, 3Rs and dates in the next section. You may find that you need to complete a few of these workplan summaries, should you have a large list of actions. We have provided a blank form at the end of this guide.

LAUNCHING THE WORKPLAN

Creating Awareness

Launching your reduction workplan needs several important actions to ensure success.

Your Waste Reduction Coordinator/Committee should be clear about the goals and objectives of the workplan. They should assign responsibilities and authorities to appropriate personnel in all project areas.

It is essential to make the right resources available. This may involve staff time to manage and operate your workplan and basic equipment to contain wastes. Consultation with end users or recycling service providers will help you identify what equipment is needed.

At the same time, your coordinator/committee should develop awareness of your workplan among all staff and workers. Open display of the workplan, as required by the Regulation, and explanation of its goals will help secure full participation.

Please note that the workplan must also be communicated to outside trades who come to work on the project. In these cases a short summary of the waste reduction workplan can be handed out, with ongoing operational directions and showing the locations of recycling bins.

Generate enthusiasm! Be imaginative, create incentives and share the results of your program so that everyone will keep up their support.

Staying on Course

To ensure success, you should monitor waste reduction performance against the targets established. You may find that additional waste reduction opportunities will arise, or find that more action is needed or different methods become available. You may need to adjust operating procedures and amend reduction targets, ideally upwards.

Current systems being developed for most projects show that it is possible to achieve sizable reductions in wastes. The coordinated efforts of all your employees can provide substantial benefits to your own operations and to the environment.

You might compare the performance of similar projects to check your reduction achievements against your targets. You can then make changes to your waste diversion targets and planned actions.

APPENDIX C: Additional Sources of Information

What to do with home renovation waste

Ontario Ministry of Environment and Energy

1-800-565-4923 (Toronto: 323-4321) or Fax (416) 323-4564

This pamphlet outlines ways to practise the 3Rs when renovating, and recommends what to do with specific materials.

Keeping C&D Materials Out of Landfills

Conserving Resources and Minimizing Waste in the Construction Industry

Ontario Ministry of Environment and Energy

1-800-565-4923 (Toronto: 323-4321) or Fax (416) 323-4564

This report summarizes the current solid waste management and waste diversion activities practised by the construction industry in Ontario. It identifies the barriers to greater diversion, and describes proposed action plans that would address these barriers, reduce waste generation and optimize diversion. The report was developed by the C&D Waste Reduction Strategy Team, a stakeholder group comprised of members of the construction industry, recycling associations, municipal and provincial agencies, labour and public interest groups.

Making a Molehill out of a Mountain II

Implementing the 3Rs in Residential Construction

Greater Toronto Home Builders Association

(613) 748-2367 or Fax (613) 748-4069

This booklet, aimed at the building industry, centres around three primary concepts: reducing waste at the source; reusing what would normally be landfilled; and recycling materials for which there is no immediate reuse. It helps contractors perform waste audits and then develop plans of action.

3Rs Code of Practice

Ontario Ministry of Environment and Energy

1-800-565-4923 (Toronto: 323-4321) or Fax (416) 323-4564

Developed by the Ontario construction industry in consultation with the ministry, the Code of Practice encourages implementation of a series of 3Rs principles.

Construction and the Environment: How Home Building and Renovators Can Help Build a Green Future

Canada Mortgage and Housing Corporation

(613) 748-2157

Describes the problems involved in disposing of residential construction waste and describes how to set up a waste management plan. Offers specific suggestions for reducing, reusing and recycling common building materials. Describes how to help protect the environment through the use of materials, fixtures and systems that permit waste and energy conservation.

Waste Management Action Plan for the Construction Industry

Greater Toronto Home Builders Association

(613) 748-2367 or Fax (613) 748-4069

Offers step-by-step instructions for setting up a waste management action plan, including how to estimate waste production, investigate disposal options, encourage workers to get involved, and develop a strategy for each phase of construction.

Waste Minimization

Construction and demolition industry fact sheet

Alberta Environmental Protection / Alberta Special Waste Management Corporation

(403) 427-5838 or 1-800-278-8873

A fact sheet on the benefits of waste minimization, implementing a waste minimization program, and alternatives.

APPENDIX D: Conversion Factors

Metric Conversions

1 Tonne	=	1000 Kilograms	=	2200 lb
1 Kilogram(kg)	=	2.2 pounds (lb)		
1 Cubic Metre(m ³)	=	1.3 cubic yards	=	35.3 ft ³

Typical Container Sizes			Typical Weights	
Cubic Yard		Cubic Metre	Pallet - Softwood	20lb/9kg
4	=	3.1	Pallet - Hardwood	30lb/13.6kg
6	=	4.6	Pallet - 1 cu. yd.	45kg *
8	=	6.2		91kg #
14	=	10.7	Drum - Steel, top	40lb/18kg
20	=	15.4	Drum - Steel	35lb/16kg
40	=	30.8	Drum - Fibre, top	20lb/9kg
			Drum - Fibre	15lb/5.5kg
			Drum - Plastic, top	35lb/16kg
			Drum - Plastic	30lb/14kg

* uncompacted # compacted

Example Densities

Material	Uncompacted(kg/m ³)	Compacted(kg/m ³)
Asphalt (milled, ripped)	800-1000	
Concrete, Brick & Block	1200-2372	
Mixed Demolition, noncombustible	1000-1600	
Mixed Demolition, combustible	300-400	
Odd Plastic	30	416
Glass	300-357	595-1189
Corrugated Container	24-27	241-342
Wood:		
pallets (c&d)	170	
dimensional lumber (c&d)	145	
sawdust/shavings	288-241	
trimmings	577	
crates	108	
Metal Scrap:		
heavy	2408	
light	803	
Mixed Residential Waste	150-300	



Waste Audit Summary
Construction and Demolition Projects
As required by Ontario Regulation 102

Name of company	Name of contact person	Telephone No.
Project site location (if applicable)		Date of audit
Type of project		
<input type="checkbox"/> Construction project	<input type="text" value="Square metres"/>	<input type="checkbox"/> Demolition project
	<input type="text" value="Square metres"/>	

Material category	Waste generated (tonnes)	Reused material (tonnes)	Recycled material (tonnes)
Total			

Materials (bought/sold) that contain recycled content	
Material	Percentage of recycled content

I hereby certify that the information provided is complete and correct, and the establishment complies with all the requirements of Regulation 102.

Signature of authorized official	Title	Date
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Waste Audit Summary Instructions
Construction and Demolition Projects

Name of Company, Project Site/Location (if applicable), and Telephone No. - write the name of your company or institution, the telephone number, and address of the project site in the spaces provided.

Type of project - check the box next to the type of project which is most appropriate, and fill in the number of square metres of floor area.

Material category - write down the type of material used or handled in your project (e.g., concrete, drywall, brick, etc.)

Waste Generated, Reused material, and Recycled material - in these columns, put in the weight in tonnes for each of the materials you listed for your project. Waste generated means the total waste generated including waste later reused or recycled. reused material means waste generated which was reused; recycled material means waste generated that was recycled.

Have an authorized official of your company sign and date this summary, stating his or her title.

Waste Reduction Workplan Summary Instructions

In the first section check the box which is most applicable to your company or establishment. Write the period for which the workplan will be in effect.

Name of Company, Project Site/Location (if applicable), and Telephone No. - write the name of your company or institution, the telephone number, and address of the project site in the spaces provided.

Total waste disposal last year - total waste generated in the year previous to the workplan, minus total waste reused and total waste recycled (if any) for that period. Please ensure all figures are in tonnes.

Material category - write down the type of waste material (e.g., fine paper, glass beverage bottles, newspaper, concrete, drywall, brick, etc.) and its weight in tonnes.

Proposed Action to Divert Materials - fill in what action you intend to take to minimize the amount of this material that ends up as waste disposal. Specify this in the next three columns (Reduction, Reuse, Recycling).

Shaded Areas are for industrial, commercial and institutional establishments use only. Construction or demolition projects do not have to complete these sections.

Have an authorized official of your company sign and date this summary, stating his or her title.