



Waste Reduction In Your Business

Waste Reduction, Recycling
and Litter Control Program

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FOREWORD

"The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment."

Source: *Resource Conservation and Recovery Act (RCRA), as amended by the U.S. Congress, November 1984*

WASTE REDUCTION IN YOUR BUSINESS is a manual prepared by the Washington State Department of Ecology to help Washington State businesses reduce the amount of waste they produce. It is intended to be a tool that business managers and their employees can use to:

1. Understand the benefits of waste reduction
2. Learn how to start a waste reduction program
3. Conduct a waste reduction audit
4. Evaluate waste reduction options
5. Know who to call for assistance

Each chapter is designed to build on the previous one, yet be self-sufficient. First read the chapter's text, then use the forms included at the end of each chapter to accomplish the tasks described in it. For assistance, call the Waste Reduction, Recycling and Litter Control Office in the Washington State Department of Ecology toll-free at 1-800-RECYCLE, at (206) 438-7541, or use the other sources listed in Chapter 6.

This manual is not intended to be used for environmental compliance. Regulatory compliance information can be obtained from the nearest Department of Ecology Regional Office or the Hazardous Waste Section of the Solid and Hazardous Waste Management Program. See Chapter 6 for their locations and telephone numbers.

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ACKNOWLEDGEMENTS

Grateful appreciation is given to the following sources for allowing their materials to be used as a basis for this manual:

1. "The EPA Manual for Waste Minimization Opportunity Assessments," July 1988, by the Hazardous Waste Engineering Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency.
2. "Profiting From Waste Reduction in Your Small Business," 1988, Produced under a grant from the Charles Stewart Mott Foundation by David Wigglesworth, Alaska Health Project.

CHAPTER 1

WASTE REDUCTION PAYS

WHAT'S THE FUSS?

You may be asking: Why all the fuss about reducing waste? I've been handling my business and its waste disposal for years. I have the situation under control and don't need to make it more complicated or costly.

The answer is that the times are changing. Improved waste management practices are becoming necessary for any business to compete profitably and successfully. Raw material costs are increasing yearly, and hazardous waste disposal costs are skyrocketing. Some of the reasons for these changes are:

- Every year more people and businesses are creating waste.
- Every year there are less land disposal options available.
- Today Washington State has no hazardous waste disposal site within its borders.
- Our knowledge of waste's effect on the environment is increasing every year.
- New laws and regulations have been enacted to address waste disposal problems.

In 1983, the Washington legislature passed the Priority Waste Management Act. The priorities for hazardous waste management, in order of desirability, are:

1. Waste reduction
2. Waste recycling
3. Physical, chemical, and biological treatment
4. Incineration
5. Solidification/stabilization treatment
6. Landfill

The purpose of this priority ranking is to provide environmental protection through prevention rather than controlling the wastes after they have been produced (at the "end of the pipe"). It attempts to treat the *source* of the problem rather than the *symptoms*. It recognizes that land disposal of hazardous waste is usually not a safe option.

When a business considers the costs of hazardous waste disposal, compliance with state and federal laws, and possible future liability for hazardous wastes, reducing the amount of hazardous waste generated begins to make good business sense. It avoids costs. It pays.

WHAT IS WASTE REDUCTION?

Waste reduction is any in-plant activity that reduces, avoids, or eliminates the generation of waste at its source. This includes recycling wastes back into the process that generates them. This definition is meant to be consistent with the goal of preventing the generation of waste at the source rather than controlling, treating, or managing waste after it's generation.

Recycling wastes, whether to another on-site process or off site, is also waste reduction. If production of the waste cannot be avoided, then the next best option is to use it up in another process, process it to reclaim a useful constituent, or process it to remove a contaminant to allow it to be reused.

Other waste management methods, including incineration or treatment to change to waste's physical, chemical or biological character, are not considered waste reduction. They may fulfill the desirable goals of reducing toxicity or even avoiding the landfilling of wastes, but since these actions deal with the waste without eliminating it at its source or recycling it into new products, they do not meet the definition of waste reduction.

Waste reduction helps your business in the following ways:

Economics

- Avoids expensive disposal costs
- Lessens the need for costly alternative treatment of waste
- Saves on raw material and manufacturing costs

Regulations

- Satisfies the certification for a waste reduction program on the hazardous waste manifest.
- Meets the RCRA/HSWA biennial waste minimization program reporting requirement.
- Reduces problems caused by land disposal restrictions and bans.
- Can possibly reduce the need for new waste handling and treatment permits which are becoming more and more costly and difficult to obtain.

Liability

- Reduces your business's liability for environmental problems at both on site and off site treatment, storage, and disposal facilities.
- Creates a safer work place.

Public Image

- Improves your business's public image.
- Improves employee morale.
- Demonstrates the company's concern for the environment.

The goal of a waste reduction program is to reduce the generation of all wastes to an absolute minimum. Businesses that want to concentrate on reducing paper, cardboard and other nonhazardous wastes are encouraged to do so. This manual will help you. Ecology has help available to start and run these programs. Call the Office of Waste Reduction and Recycling toll free at 1-800-RECYCLE or at (206)438-7541 for information and assistance.

The focus of this manual is on liquid and solid hazardous wastes, but wastes into any medium (air, water, land), whether hazardous or nonhazardous, should be included in the waste reduction program. Shifting a waste from one medium to another, for example from water to air, is not waste reduction.

Now that some background into the what and the why of waste reduction has been presented, let's start on the how of it. The next chapter will help you get started in establishing your waste reduction program.

CHAPTER 2

LET'S GET STARTED!

Successful waste reduction requires teamwork. If managers and employees work together and are committed to the goal of reducing waste, you will see positive results. This chapter shows you how to form an audit team to direct this effort. The audit team can also:

- Encourage employees to voice their opinions on waste reduction and all waste problems
- Educate management and employees about waste management issues in general
- Catalyze an effort to improve procedures and processes

The first steps in setting up your waste reduction program are:

1. Get management support
2. Create the audit team
3. Set the team's goals

MANAGEMENT'S ROLE

Management's role is to give direction and support, to set the tone and direction of the waste reduction effort. A good way to start is to write a formal environmental policy for the company that includes waste reduction as an essential element. For example:

(Your company's) ENVIRONMENTAL POLICY

(Your Company) is committed to operating in a way that protects the environment. This is a management responsibility as well as the responsibility of every employee.

In keeping with this policy, our objective as a company is to reduce waste and achieve minimal adverse impact on the air, water, and land through excellence in environment control.

The Environmental Guidelines include the following points:

- Minimizing or eliminating the generation of waste is a prime consideration in all business activities.
- Reuse and recycling will be given first consideration when classifying materials for disposal
- Environmental protection is a measure of employee performance.

Modify this example policy as you feel best suits your business. Have it attractively typed or printed, then distribute it to employees and also post it in a public area of your business.

CREATING THE TEAM

Each area of the business should be represented on the audit team. For a small business, membership could be just the owner/operator and an employee. In a larger business it might include management, production, maintenance, environmental, engineering, sales, purchasing, and more. The purpose is to get help and ideas from every possible source in your business. Include everyone.

General rule to follow in forming and running an audit team are:

- Select a motivated, knowledgeable employee to be the team's leader.
- Hold regular, scheduled meetings. This promotes progress through deadlines and also allows sharing of new ideas and information.
- Keep records of meetings and activities for your own information and to fulfill the legal requirements of having a waste minimization program created by Congress with the 1984 HSWA amendments to RCRA.

WASTE REDUCTION GOALS

Goal setting is the next step. The audit team's goals should be in agreement with overall company goals. They can be qualitative, like "Our goal is to significantly reduce our waste stream," but quantitative goals are better because you can see when you reach them. An example could be "Our goal is to cut the waste volume from the plant in half." In some businesses goals could be as ambitious as "We will have zero discharge of hazardous waste from our business." Be practical, but use a little vision and optimism.

Record your audit team goals on the Waste Audit Team membership form along with each team member's name. Give a copy to each member and post one copy in an appropriate public place.

THE WASTE REDUCTION AUDIT TEAM

Company: _____

—

Date: _____

—

Audit Team Goal:

—

—

—

—

All employees with questions or suggestions regarding waste management and waste reduction are encouraged to contact any one of the people listed below:

Team

Leader: _____

Location: _____

—

Team

Leader: _____

Location: _____

—

Team

Leader: _____

Location: _____

—

Team

Leader: _____

Location: _____
—

Team
Leader: _____

Location: _____
—

Team
Leader: _____

Location: _____
—

CHAPTER 3

YOUR BUSINESS' PLANS, PROCEDURES, AND WASTE REDUCTION

After you have obtained management's support, created the audit team, and set the team's goals, the next step is to take an overall look at your business' plans and procedures. This chapter can help you do that.

Business plans and procedures need to be designed to promote waste reduction. Care must be taken not to "build into the system" procedures that cause excess waste to be generated. This chapter helps the audit team examine the marketing, operations, and financial areas of a business to see how each one can influence or be influenced by waste generation.

A checklist is at the end of this chapter to help organize your thoughts as you read through the following sections.

YOUR BUSINESS PROCEDURES AND WASTE REDUCTION

If you are starting up or expanding a business, it is especially important to consider waste reduction in all planning. By considering waste reduction right from the beginning, you can avoid many waste related problems, making your business more efficient and competitive.

Each section of your business either affects or is affected by the quantity of waste your business generates. This includes all business activities, not just the production area. The way you plan and conduct your marketing, operations, and financial activities will have either a positive or negative effect on your waste reduction effort.

Let's now look at the procedures that you use in several areas of your business and see how they relate to your waste reduction program.

MARKETING

Waste reduction will reduce your waste management costs. Funds and efforts can be directed to more pressing areas of your business, giving you a competitive edge over another business still saddled with high waste disposal requirements.

A successful waste reduction program can be used to generate publicity and give your business valuable recognition by both the public and your business peers. An article in the local newspaper or a trade journal portraying your progressive, forward-looking approach to waste management can give your business name recognition and create a favorable public image.

Bad publicity from improper management of waste can be devastating to your company's image.

OPERATIONS

Operations, as defined here, is a broad category that includes all activities directly involved with making the product or providing the service. Most wastes are generated in this area and it usually has the greatest potential for waste reduction. Let's divide operations into several functions, then look at how each affects waste production. The functions are:

1. Processing
2. Purchasing
3. Receiving
4. Delivery
5. Inventory
6. Personnel

Processing:

When the audit team is evaluating the processing area of your business, consider these general measures:

Source reduction:

Evaluate equipment and procedures to eliminate or reduce waste production at the source. Spills can be minimized through careful equipment and facilities design. Changes that promote recycling and recovery of wastes are desirable.

Scheduling procedures:

Schedule production to minimize equipment cleaning. Producing compatible products in blocks minimizes the quantity of wastewater or solvent generated.

Waste segregation:

Keep wastes separate. This promotes the possibility of recycling. It also can reduce the volume of hazardous waste you have to deal with. Mixing hazardous and nonhazardous wastes makes all of the waste hazardous.

Maintenance programs:

A preventive maintenance program will help reduce leaks and wastes caused by equipment breakdowns and unscheduled shutdowns. Minimizing waste generation should be an essential part of all painting, cleaning, degreasing, and repair projects.

Purchasing:

Purchasing procedures can help control waste generation. Before buying a material, consider:

Centralized purchasing:

Route all purchases through one person or department. This makes it easier to uniformly apply waste reduction purchasing policies.

Pre-purchase review:

Buy nontoxic (or the least toxic) material for the job. Use compatible products (for instance standardize on one or a minimum number of solvents) to enhance recyclability of wastes that are generated.

Minimize types of raw materials:

Reduce the number of raw materials (for instance, solvents) in your product line as much as possible. This minimizes the small odd lots of materials left over and promotes recyclability.

Inventory control:

Buy only what you need. Over-purchasing ties up your capital as well as promoting losses through spills and having to dispose of unused, old, out-of-specification materials.

Equipment purchases:

When evaluating new equipment, make reduced waste production as important a criterion as technical considerations, safety and price.

MSDSs:

Material Safety Data Sheets contain manufacturer's information on a material's chemical, physical, and toxicological properties as well as proper handling and storage procedures. Business is required to have one for each hazardous material on the business site. MSDSs on process materials can help determine the nature of your businesses wastes and comply with Right To Know laws.

Expansion plans:

Always consider waste reduction when planning for new construction or purchase of existing sites. Avoiding waste is the most cost effective waste management practice. Carefully examine any prospective property purchases for hazardous wastes such as previously spilled materials, asbestos, or PCBs. If you purchase a property that has environmental problems, you could become liable for their clean up.

Receiving:

All materials entering your business site go through receiving procedures. Proper procedures will promote worker safety and minimize waste generating problems such as broken or leaking containers, damaged merchandise, and spills from tank car and tank truck unloading. A few good practices to consider are:

Designate a receiving area:

All materials should be received through designated receiving areas. This gives you control of materials as soon as they are on your property. Receiving records can then be carefully maintained. Facilities and personnel are available to handle incoming material in a professional and timely manner. Facilities can be designed to prevent and control spills.

Train employees:

Employees should be trained to properly handle shipments to prevent property losses, injuries, and costly waste disposal. They should understand any hazardous potential of the incoming materials and the standard procedures to take if there is an accident.

Know your supplier:

Buy only from suppliers that deliver products to you well packaged and in good condition.

Inspect incoming goods:

Immediately check all incoming goods for damage, leaking containers, quality specifications, etc. Quick action when a problem is discovered can save you the costs and trouble of spill cleanup. It also helps relieve you of the responsibility to pay for contaminated or off-specification material.

Delivery:

Well thought out delivery procedures will protect your business and reduce waste. They are complementary to procedures for receiving materials. Some suggestions are:

Deliver to a designated receiving area:

This promotes completed paperwork, safety, and efficient delivery.

Train your customer's employees:

Your product will be properly handled and stored. This can be done through careful training of your delivery employees.

Customer inspection of your product:

When the customer inspects your product before signing the receiving papers, later returns are greatly reduced. You also get immediate feedback on shipping or quality problems with your products. Off specification or damaged products returned long after shipment tend to be considered "odd balls" and are harder to recycle or reuse.

Inventory:

Inventory represents your business' money tied up in goods. Extra stock and too many different items can lead to safety problems and excess waste generated. Stocking up on a "good buy" can end up costing more money if the unused materials must be disposed of. When reviewing your inventory procedures, consider:

Materials Inventory:

Excess inventory or reactive, toxic, or ignitable materials increases the chances of spills, worker exposure, and fires.

Container size:

Try to purchase materials in a container sized to the amount you are going to use. Transferring from large containers (like 55 gallon drums) to smaller ones for small uses invites spills, evaporation, and contamination of the remaining material if some is returned to the drum. The left over material is a storage problem and promotes worker exposure. It then becomes a disposal problem.

Storage area:

Is it clean, efficient, and safe? Is it designed for easy cleanup and to contain spills? Is there adequate (or any) fire protection? Are incompatible materials stored next to each other (like acids and bases, or ammonia and bleach)? Separate storage areas might have to be provided for reactive materials (like peroxides).

Shelf life:

Outdated inventory has to be disposed of at your expense. If outdated materials are accidentally used for production, what is the effect on your product? It could mean product returns and disposal costs.

Product and process changes:

When a product or process is changed, raw materials, already in inventory are sometimes no longer needed. Suppliers will usually charge a restocking fee if they will take back the materials at all. Finding another user for the materials is a good, cost-effective solution, but be sure that the user properly manages your materials. Liability for his mismanagement of your material can come back to you.

Personnel:

Progressive personnel policies encourage employees to develop their knowledge and skills. Well-trained employees will handle materials and operate equipment properly, minimizing accidents and losses. Safety, material handling, process specific courses, and professional development are several education areas to be considered.

Policies should encourage long term employment for valued employees. Spills and accidents happen more often to the new employee who is just learning the job.

FINANCES

A business must make a profit. If waste management costs are charged directly to the process that generates them, you get a truer evaluation of that process's profit/loss status.

Estimating a product's profitability requires detailed records of all business costs, including waste management. Sometimes this is difficult, especially for a small business that cannot afford to dedicate the needed time and effort to the task. Records of costs incurred due to a waste's disposal, transportation, management overhead, regulatory compliance, insurance, etc. are essential to evaluate the cost effectiveness of any planned or existing waste reduction measures.

REVIEW BUSINESS PLANS AND PROCEDURES

Company: _____

Date _____
 Completed: _____

Person Completing _____
 Form: _____

INSTRUCTIONS: Check the appropriate answer for each question.
YES means your business procedures promote or could promote waste reduction.
NO means your procedures are not encouraging waste reduction.
NOT SURE means you need to further evaluate your procedures in that area.

	YES	NO	NOT SURE
A. Questions Specific to Marketing			
1. Do you and your employees recognize the importance of proper management of hazardous materials and waste reduction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Do your marketing strategies incorporate the positive public image related to waste reduction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Do you publicize your company's efforts to reduce waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Questions Specific to Operations			
1. Are workers and management developing a program to promote waste reduction in your company?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Have you looked at your procedures to promote source reduction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Are you recycling every waste that you can?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Do you know the quantity of waste (liquid, solid and gaseous) produced by each process in your business?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Do you keep your operations area clean and orderly to enable you to keep track of chemical handling and process operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Do you regularly use paper and can recycling centers available in your community?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. If you produce waste air emissions, have you determined if the raw materials in them can be reclaimed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Do you segregate process waste streams?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Do your workers know which processes produce wastes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Does your operations plan include periodic waste reduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

audits?

11. Do you ask for MSDSs to evaluate raw materials prior to purchase to ensure you are using the least toxic materials possible and to identify possible waste streams?

	YES	NO	NOT SURE
12. Do you limit your inventory stock to prevent possible spills, avoid overpurchasing, and other waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Do you request information regarding the types and quantities of waste generated by equipment you plan to purchase?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Do your purchasing agreements include provisions for inspecting shipments prior to acceptance to ensure they are not leaking or otherwise damaged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Do you attempt to exchange those wastes that cannot be reduced with other companies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Can your fire suppression system handle a major emergency involving the chemical and hazardous materials you have?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Are your storage areas designed to control spills and other mishaps?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Are all of your workers trained on what you do in the event of a hazardous materials incident?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Does your company policy promote employee training and development in the area of waste reduction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Do you keep written policies to document standard plant operation procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Do you keep records on the amount of raw materials used per process to monitor process efficiency?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Do you maintain logs on the types and quantities of waste produced by your company so that you can target certain waste for waste reduction opportunities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Questions Specific to Finances	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1. Do you consider the cost of waste disposal when developing profit and loss statements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Do you know the waste production costs associated with the various processes in your business?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If yes, do you charge the cost directly to the process when figuring prices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CHAPTER 4

CONDUCT YOUR WASTE REDUCTION AUDIT

In the last chapter you took a general look at each area of your business for its potential to generate waste. This chapter focuses on your production processes to complete your waste reduction audit. There are four steps:

- A. Identify the wastes generated and the processes that generate them.
- B. Do a walk-through of the production area.
- C. Create a preliminary list of waste minimization options.
- D. Document all of your findings.

A set of forms at the end of this chapter will help you complete your audit.

THE WASTE REDUCTION AUDIT

The size and type of your business determines how much effort must go into a waste reduction audit. The owner of a small, uncomplicated business might complete an audit alone in less than a day. Large manufacturing businesses could require a team of skilled professionals to do extensive waste stream analysis, engineering studies, and economic analyses.

A. IDENTIFY THE WASTES GENERATED AND WHAT MAKES THEM

The task of identifying wastes and the processes generating them is started by looking into your company records. Identify type, contents, quantities, and rates of all wastes produced. Include nonhazardous wastes, wastes going to the air, and energy losses. This audit concentrates on liquid and solid hazardous wastes, but ALL losses cost you money. Some sources to search for information are:

- Waste manifests
- Documentation on any shipping or processing of wastes
- Permits
- SARA Title III Section 313 reports
- Lab analyses
- Annual reports to state or federal agencies
- Past inspection reports

Process and equipment information can be obtained from:

- Operating manuals
- Process manuals
- Blueprints and drawings
- Equipment specifications
- Employee interviews (especially those from production or maintenance)
- Operating logs
- Vendors

Raw materials usage and analysis information comes from:

- Inventory and purchasing records
- Production records
- MSDS sheets
- Package labels
- Suppliers

Determine the costs of raw materials, product manufacture, and waste disposal, using purchasing and accounting records. This gives you an idea of how expensive a loss of raw material or product is. It also lets you know how much you can save by eliminating each pound of waste.

Review the assembled information with the audit team. Make sure that the information is as complete as possible. It might help to draw a process flow diagram showing the types and quantities of all raw materials going into the process and all outgoing products and wastes. This visual aid will help make the balance between quantities of input and output materials easier to do.

While discussing the collected data with the audit team, it would be useful to review the general types of waste reduction opportunities that are available. In the last chapter, these opportunities were grouped according to your business organization. Let's now put them into two categories: source reduction and recycling.

1. **Source reduction techniques** have the highest priority in waste management. If you don't make a waste, you don't have to deal with it later. They include:
 - a. **Good operating practices:** A change in how you run your business may be the easiest, least expensive, most cost effective way to reduce waste. These practices include:
 - **Management and personnel:** employee training, incentives and bonuses, and other programs can encourage employees to conscientiously strive to reduce waste.
 - **Material handling and inventory:** reduce loss of raw materials due to mishandling, expired shelf life of time-sensitive materials, or improper storage conditions.
 - **Loss prevention:** avoid leaks, spills, etc.
 - **Waste segregation:** Do not mix hazardous and nonhazardous wastes, because this makes the whole mixture hazardous. Also, keep different types of hazardous wastes separate to promote treatability and the possibility of recycling.
 - **Cost accounting:** allocate waste treatment and disposal costs directly to the departments or groups that generate waste, rather than charging these costs to general company overhead accounts.
 - **Production scheduling:** reduce frequency of equipment cleaning by carefully scheduling batch production runs of compatible and incompatible products.
 - b. **Technology changes** involve process and equipment modifications to reduce waste. They can include:
 - Changes in the production process
 - Equipment, layout or piping changes
 - Use of automation
 - Changes in process operating conditions

- c. **Raw material changes** can reduce or eliminate hazardous materials entering the production process. Generation of hazardous wastes is then reduced.
 - d. **Product changes** can reduce the waste generated from a product's use. An example is the substitution of water based for solvent-based paint. Flammable solvents, messy equipment cleanup, and volatile organic vapor emissions are eliminated.
2. **Recycling techniques** take a waste and either reuse it or reclaim it. Wastes are put to a beneficial use rather than disposed of.
- a. **Use/reuse:** This means returning the waste to its originating process or using it in another process as a raw material to make a new product.
 - b. **Reclaim:** Reclamation is the recovery of a valuable material from a waste. The material could be used in the original process or sold to another company. Examples include the recovery of lead from spent batteries, the regeneration of spent solvents by a reclaimer, and recovery of silver from film processing.

B. TAKE YOUR TOUR THROUGH THE PRODUCTION AREA

Before you start your walk-through, make a plan for the tour. Make sure your agenda covers all areas on the plant site. You could begin at shipping/receiving, then continue on through the process until you get to product storage and waste disposal. Be thorough and actually look at everything yourself. You might feel that you know the area well enough to skip it, but it is important that the whole audit team actually sees the whole process.

Schedule the walk-through at a convenient time for all members of the audit team. Try to tour when your most important activities or processes are in operation, not when they are shut down. If the plant has an evening or graveyard shift, consider making a second or third plant tour on these later shifts. Maintenance, supplies, and supervision are usually less available then. This sometimes leads to different operating procedures than on the day shift.

While you are making the tour, compare the collected data from the pre-audit work to what you actually see. Seeing the activities you have reviewed helps make them clearer in your mind. Ask yourself questions like

- Is the process actually the same as visualized when reviewing information before the walk-through?
- Have undocumented changes been made in the process or its standard operating procedure?

Record all your observations as you see them while taking your tour. Take pictures. Sketch the process and its surrounding area. Discuss observations with other team members. Notes and pictures help you organize your thoughts and remember details.

Talk with workers in the area. This includes operators, supervisors, and maintenance people.

Refer to the "Questions to Consider" list to help you with this section.

C. MAKE A LIST OF ALL WASTE REDUCTION OPTIONS

Now comes the creative part of the audit process. Turn the observations and information you have collected into a list of possible options for waste reduction. List all options that are generated, no matter how impractical or costly. Let your imagination run freely. Be creative and think independently. The longer the list the better.

Discuss possible options among yourselves. The more you work at it, the more options you will come up with. Chapter 6 lists local, state and federal agencies that have resources to help. For more suggestions, you might contact:

- Washington State Department of Ecology's Office of Waste Reduction and Recycling toll free at 1-800-RECYCLE or (206)438-7541
- Vendors and suppliers
- Trade journals
- Trade associations
- Local government agencies
- Private consultants

As you generate options, list them in the order of those that:

1. Reduce waste production at the source
2. Recycle within the waste generating process
3. Recycle outside of the waste generating process
4. Treat or process to reduce volume or toxicity, or to enhance recyclability
5. Other

Environmental, the higher on the list, the more desirable the option. Waste reduction tries to not make waste in the first place. Incineration and some kinds of treatments fulfill the goal of reducing the amount of waste to be landfilled, but they are not true waste reduction.

D. DOCUMENT YOUR FINDINGS

File all audit team findings, data, and meeting records with your normal business records. This will:

- Document the activities of the audit team.
- Serve as a record of the good faith efforts of your company to control pollution and protect workers and the community.
- Provide base line data to allow the audit team to determine if selected waste reduction efforts actually reduce waste and save money.
- Provide the foundation for your developing waste reduction program.

QUESTIONS TO CONSIDER DURING YOUR PLANT TOUR

These general questions will help you focus your attention on possible waste sources in your company. Your initial impressions can provide vital clues about how your wastes are generated, and how they might be controlled. Keep this list of questions with you as you do your plant tour, and when you complete the rest of the forms in this chapter.

1. Does your facility show signs of poor housekeeping (cluttered walkways, unswept floors, uncovered material drums, etc.)?
2. Are there noticeable spills, leaking containers, or water dripping or running?
3. Is there discoloration or corrosion on walls, work surfaces, ceilings and walls, or pipes? This may indicate system leaks or poorly maintained equipment.
4. Do you see smoke, dirt, or fumes to indicate material losses.
5. Do you smell strange odors, or experience eye, nose, or throat irritation when you first enter the workplace? These symptoms might indicate system leaks, etc.
6. Are there open containers, stacked drums, shelving too small to properly handle inventory, or other indicators of poor storage procedures?
7. Are all containers labeled as to their contents and hazards?
8. Is emergency equipment (fire extinguishers, etc.) available and visible to ensure rapid response to a fire, spill or other incident?
9. Do you notice waste being generated from processes in your facility (dripping water or steam, evaporation, drag-out, etc.)?
10. Do you notice any scrap or out-of-specification parts lying around?
11. Check your inventory. Is there any outdated stock, or materials that you no longer use still in storage?
12. Do employees have any comments about the sources of waste in the facility?
13. Is there a history of spills, leaks, accidents or fires in your facility? Which processes were involved?

PROCESS IDENTIFICATION

INSTRUCTIONS: Copy this form and use one sheet for each process in your business. This form is intended to help you identify and organize information on each process in your business.

Process: _____

Documents	Available? Y/N	Comments
Process Description		
Process Flow Diagram		
Process Flow Measurements		
Process Stream Analyses		
Piping & Instrument Diagrams		
Plot and Elevation Plan(s)		
Work Flow Diagrams		
Operating Manuals		
Equipment List		
Equipment Specifications		
Batch Sheet(s)		
Product Composition Sheets		
Inventory Records		
Operator Logs		
Production Schedules		
Material Safety Data Sheets		
Hazardous Waste Manifests		
Emission Inventories		
Annual/Biennial Reports		
Permit/Permit Applications		

RAW MATERIALS IDENTIFICATION

INSTRUCTIONS: Copy this form and use one sheet for each process in your business. This form is intended to help you identify the types and quantities of raw materials used in each process.

Process: _____

Raw Material (Trade or Chemical Name)	Amount Used Units ()
1. _____ _____	_____ _____
2. _____ _____	_____ _____
3. _____ _____	_____ _____
4. _____ _____	_____ _____
5. _____ _____	_____ _____
6. _____ _____	_____ _____
7. _____ _____	_____ _____
8. _____ _____	_____ _____

WASTE VOLUME AND COST SUMMARY

INSTRUCTIONS: Copy this form and use one sheet for each process in your business. This form is intended to help you identify the volume and cost of wastes generated by each process in your business.

Process: _____

Attribute	Stream #1	Stream #2	Stream #3
Waste ID/Name			
Source/Origin			
Component or Property of Concern			
Generation Rate (Units)			
Total			
Component(s) of Concern			
Method of Waste Disposal (recycle, RCRA landfill, etc.)			
Costs of Waste Management Overall Disposal (\$ per year)			
Unit disposal (\$ per)			
Management Time (# of man-hours)			
Regulatory Compliance (fees, penalties, other)			
Worker Injury or Illness			
Utilities			
Insurance			
Other costs			

WASTE REDUCTION OPTION DESCRIPTION

INSTRUCTIONS: Make enough copies of this form to list and describe each option you have generated. This form is intended to show which waste stream, raw materials, and product the option influences. It also records if the option deserves further study or not.

Option Name: _____

Briefly describe the option: _____

-

-

-

-

-

-

Waste Stream(s) Affected: _____

Raw Materials Affected: _____

-

Product(s) Affected: _____

Approved for Further Study: Yes No, by: _____

Reason: _____

-

-

-

-

CHAPTER 5: EVALUATE AND IMPLEMENT YOUR OPTIONS

You have now done a walk-through of the processing area and created an extensive list of possible waste reduction options. It is time to:

1. Screen out those options that are obviously not practical.
2. Evaluate the remaining options for technical and economic feasibility.
3. Start planning to implement the options you feel are good for your business.

Each business is unique. It has its own product or service, its own budget limitations, and its own people resources. Waste reduction options have to be considered under these restraints, but remember that any waste reduction effort you undertake will be beneficial to both you and the environment.

A. SCREEN THE PRELIMINARY LIST OF OPTIONS

Have the audit team meet to screen and rank the waste reduction options. As you go down the list, it will become obvious that several options are not practical for one reason or another. Eliminate them.

Next, rank the remaining possible options in this suggested order of environmental preference:

1. Reduce waste production at the source
2. In process recycling
3. Out of process recycling
4. Treat or process to reduce volume or toxicity, or to enhance recyclability

Remember that only source reduction and in process recycling are true waste reduction options. Some treatment technologies are desirable because they reduce the volume or toxicity of wastes, but they do not fall within the definition of waste reduction. Treatment technologies usually require more monitoring and permitting by regulatory authorities than do source reduction activities.

Other points to consider:

- Track record of the option: Has it been successful before? Be skeptical if it is very new and untried. High tech, complicated technologies are not necessarily the best solutions. Contact other businesses that have tried using this technology to get reliable, firsthand information about it.
- Benefits: What is its main benefit (save money, reduce liability, comply with law, better workplace safety, etc.)?
- Problems: What difficulties can be expected (product quality changes, new production methods required, long held attitudes require changing)?
- Implementation: Is it simple or complicated? Can it be done quickly or will it take a long time? Can it be done without disrupting production and daily operations?
- Cost: How much will it cost to install? Is this option cost effective for your business? What is the annual incremental operating cost? Will it help avoid future waste disposal costs or reduce raw material costs?

B. EVALUATE THE REMAINING OPTIONS

Some waste reduction options will stand out as simple, low cost, and easy to do. Good housekeeping and waste segregation practices are typical examples. The decision to implement these is straightforward. Do them first.

Options whose value is not so obvious require a more in-depth evaluation of economic and technical feasibility. Forms for this purpose are at the end of this chapter. If you need a more detailed analysis, you can get more assistance from:

- Washington State Department of ecology
Waste Reduction, Recycling and Litter Control Program
1-800-RECYCLE or (206)438-7541
- Sources listed in Chapter 6

C. IMPLEMENT OPTIONS

Cost is the primary concern for most businesses. Low-cost, low-technology waste reduction options are usually the easiest to implement. They bring significant, cost-effective, immediate results. Costlier, more difficult options can be done as time and budget allow. Some examples of low-cost options are:

- Good housekeeping to prevent spills
- Inventory control so that you buy and use only what you need
- Segregating wastes to permit recycling (for example, don't mix solvents and oil)
- Repairing all sources of leaks
- Educating employees about waste reduction and hazardous materials control.

Review Chapters 3 and 4 for other possible low cost options.

Higher cost, more difficult options need to be implemented similarly to any larger business project with thorough, carefully done technical and economic justification.

D. EVALUATE AND FOLLOW-UP

After a waste reduction option has been implemented, it is important to document what you did and then continue to track performance. This before and after data will be helpful when evaluating the success of your program. It also might help someone else to solve a similar problem if you can share your experiences with them.

It is important to realize that sometimes new procedures and operating practices take a little getting used to. Both employees and management might need some time and follow-up to make a new process or procedure work as planned.

Another reason for continued follow-up is that a successful waste reduction program cannot be a one shot affair. Lower priority options need to be planned for and implemented. The program must be able to respond to changing circumstances such as changes in raw materials, higher waste management costs, new regulations, new technology, or accidents such as a major spill.

A waste reduction program should be reviewed periodically, at least every year.

To be truly effective, the philosophy of waste reduction must be an integral part of the business's daily operations. The most successful waste reduction program to date have all developed this philosophy within their companies, making it an integral part of every daily decision, plan, and operation.

TECHNICAL EVALUATION HELP

Company: _____

—

Date Completed: _____

Person Completing Form: _____

INSTRUCTIONS: Copy this form so that you have one form for each option you are evaluating. Check the appropriate response. Skip over questions that do not apply. The purpose of this form is to suggest several technical questions for each option.

Waste Reduction Option: _____

	YES	NO	NOT SURE
1. Have you determined that this option has a proven track record?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Will this option maintain product quality?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Will this option adversely affect productivity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Will this option require additional staff?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Are you certain that this option will create less waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Are you certain that this option will not simply move waste problems from one form to another (e.g. from solid wastes to air emissions)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Is your plan layout and design capable of incorporating this option?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Will the vendor guarantee this option?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Have you determined that this option will improve or maintain worker safety and health?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Does this option reduce wastes at their source?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Are materials and parts readily available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Can this option be easily serviced?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Are other businesses using this option?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Does this option promote recycling?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ECONOMIC EVALUATION HELP

Company: _____

—

Date

Completed: _____

Person Completing

Form: _____

INSTRUCTIONS: Copy this form so that you have one form for each option you are evaluating. Check the appropriate response. Skip over questions that do not apply. The purpose of this form is to suggest several economic questions for each option.

Waste Reduction

Option: _____

	YES	NO	NOT SURE
1. Is this option within your price range (consider both capital and ongoing operations costs)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Does this option have an acceptable payback period (under one year is considered excellent)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Does this option reduce your raw material costs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Does this option reduce your utilities costs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Does this option reduce material and waste storage costs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Does this option reduce regulatory compliance costs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Will this option reduce the costs associated with worker injury or illness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Will this option reduce your insurance premiums?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Will this option reduce your waste disposal costs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

PROFITABILITY

INSTRUCTIONS: Use this form to calculate the simple payback period of an option under consideration. If you want to do a more detailed economic analysis, the Department of Ecology, Office of Waste Reduction has copies of other published methods available.

Capital Costs

Purchased Equipment	_____
Materials	_____
Installation	_____
Utility Connections	_____
Engineering	_____
Start-up and Training	_____
Other Capital Costs	_____
Total Capital Costs	_____

Incremental Annual Operating Costs

Change in Disposal Costs	_____
Change in Raw Material Costs	_____
Change in Utilities Costs	_____
Change in Other Costs	_____
Annual Net Operating Cost Savings	_____

Payback Period (in years) = $\frac{\text{Total Capital Costs}}{\text{Annual Net Operating Cost Savings}}$ = _____

WASTE REDUCTION PROGRAM REVIEW

Company: _____

Date: _____ Date of Last Audit: _____

Person Completing Form: _____

INSTRUCTIONS: Check the appropriate response. Keep this form to compare with future annual evaluations. This form is intended to help track the progress of your waste reduction program.

1. Have you implemented all of the previously identified options? Yes No
Describe

2. Does waste reduction remain a priority for workers and _____ Yes No
Describe

3. Have your waste reduction efforts reduced costs through:
- Reduction of raw material costs YES (estimated \$ _____) NO
 - Savings on pollution control equipment YES (estimated \$ _____) NO
 - Reduced compliance costs YES (estimated \$ _____) NO
 - Reduced disposal costs YES (estimated \$ _____) NO
 - Improved safety and health YES (estimated \$ _____) NO
 - Other _____ YES (estimated \$ _____) NO

4. How effective have your efforts been at reducing the following types of wastes:

Type of Waste	Amount Reduced per Year
<input type="checkbox"/> Air Emissions	_____
<input type="checkbox"/> Evaporative waste	_____
<input type="checkbox"/> Hazardous wastes (reactive, ignitable, corrosive, toxic)	_____
<input type="checkbox"/> Heat or energy losses	_____
<input type="checkbox"/> Maintenance and cleanup waste	_____
<input type="checkbox"/> Obsolete or outdated stock	_____
<input type="checkbox"/> Overspray	_____
<input type="checkbox"/> Solid wastes (paper, boxes, trash)	_____
<input type="checkbox"/> Spills and container leaks	_____
<input type="checkbox"/> Spoiled production runs	_____
<input type="checkbox"/> System leaks (pipes, joints, etc.)	_____
<input type="checkbox"/> Wastewater	_____
<input type="checkbox"/> Other	_____

CHAPTER 6: WASTE REDUCTION RESOURCES

A. WASHINGTON STATE DEPARTMENT OF ECOLOGY

1. WASTE REDUCTION AND RECYCLING INFORMATION - Waste Reduction, Recycling, and Litter Control Program

The Office of Waste Reduction, Recycling, and Litter Control (WRRLC) has been established within the Washington State Department of Ecology to provide technical assistance to businesses and local governments on waste reduction and recycling. Resources available include:

- a. Professional staff to answer questions and provide technical assistance.
- b. A Technical Information Center containing a wide range of waste reduction and recycling related publications.
- c. Materials and assistance to help develop waste reduction plans required by the Hazardous Waste Planning Law (WAC-307, established by ESHB 2390).

For more information, contact the Ecology Regional Office nearest you (their phone numbers are listed in Section 2) and ask for the Waste Reduction and Recycling Section, or contact the headquarters office at:

Street address:		Mailing address:
4407 Woodview Drive SE	or	MS PV-11
Lacey, WA 98503		Olympia, WA 98504-8711

Telephone: 1-800 RECYCLE or (206)438-7541

2. REGULATORY INFORMATION - The Solid and Hazardous Waste Management Program

For regulatory information on the specific wastes that your business generates, call the department of Ecology Regional Office nearest you during normal business hours.

They are:

- a. Northwest Regional Office (Redmond) (206)867-7000
- b. Southwest Regional Office (Tumwater) (206)753-2353
- c. Central Regional Office (Yakima) (509)575-2490
- d. Eastern Regional Office (Spokane) (509)456-2926

For information on Community Right To Know, Small Quantity Generator regulations, general questions about the State Dangerous Waste regulations, or information about health, safety, and management of hazardous substances, call:

Hazardous Substance Information Office 1-800-633-7585.

B. MUNICIPALITY OF METROPOLITAN SEATTLE (METRO)

322 West Ewing St.
Seattle, WA 98119
(106)684-2330

METRO has a Small Business Hazardous Assistance Program for all small businesses and also an Industrial Waste Section that can provide assistance to businesses that discharge to the METRO sanitary sewer system.

METRO also supports the statewide Waste Information Network (WIN). WIN is a network of business and agency professionals working to improve waste reduction and recycling in Washington State.

C. THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA)

Region 10 EPA
1200 Sixth Avenue
Seattle WA 98101
(106)553-5810

Region 10 EPA is the Northwest area contact for all EPA regulatory programs. It also maintains a lending library open to the public from 8:30-4:30 Monday through Friday. This library contains all EPA produced reports plus reference materials from other sources. A mailing service is provided for inquiries outside of the Seattle metropolitan area. A computerized catalogue of all nationwide EPA libraries can be remotely searched (there is a charge for computer time).

Pollution Prevention Office (PM-222B)

401 M St. SW
Washington DC 20460
(202)245-3557

This EPA office is the main national EPA contact point for pollution prevention information. It can provide general information on pollution prevention activities including fact sheets, clearing house information, and a pollution prevention training manual.

Pollution Prevention Information Clearinghouse

SAIC
8400 Westpark Drive
McLean VA 22102
(703)821-4800

The PPIC provides free, non-regulatory pollution prevention related information through two toll free hotlines (the RCRA and Small Business hotlines referenced later), the electronic Pollution Prevention Information Exchange System (PIES), and a hard copy library of various EPA, state, and private publications. Typical subjects include case studies, state program and legislation review, training and education materials, calendar of events, and other related information.

To access the PIES system, set your PC communications software to "no parity, 8 data bits, and 1 stop bit." Then dial (703)506-1025. New users will be asked to complete an on line registration form. There are no user fees or on line charges.

RCRA/Superfund Hotline: 1-800-424-9346

This hotline will respond to questions about the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Underground Storage Tanks (UST), the Superfund Amendments Reauthorization Act (SARA), and the Chemical Emergency Preparedness (CEPP) Community-Right-to-Know/Title III program. It also answers questions about the Pollution Prevention Information Clearinghouse activities (see the PPIC reference on page 32).

Small Business Ombudsman Hotline: 1-800-368-5888

This hotline is a good contact to help the individual or small business locate the proper government hotline, office, etc. to deal with a given question or problem. It has about 200 publications for distribution, many of which deal with interpretation of EPA regulations. It answers questions about the Pollution Prevention Information Clearinghouse (see the PPIC reference on page 32). It is small, but staffed with experienced people.

Emergency Planning and Community Right To Know Hotline: 1-800-535-0202

This hotline will respond to any SARA Title III related questions. This includes helping fill out yearly reporting forms and sending out documents.

Office of Research and Development

Waste Minimization Branch
26 West Martin L. King Drive
Cincinnati, OH 45268
(513)569-7215

This EPA office is responsible for research, development, and demonstration programs concerning pollution prevention and waste reduction.

Office of Solid Waste

Waste Minimization Branch (OS-320W)
401 M Street SW
Washington DC 20460
(703)308-8402

This EPA office is a good contact for questions regarding RCRA related national waste minimization policies and planning.