



POLLUTION PREVENTION FACT SHEET

Pollution Prevention Program - Federal Programs Division

Fact Sheet #3: (Revised)



Hazardous Waste Minimization: Reducing Waste at the Source

This Pollution Prevention Fact Sheet is one in a continuing series prepared under the Pollution Prevention Program of the Federal Programs Division of Environment Canada, Ontario Region. This Program is intended to help federal departments in Ontario become model environmental citizens by managing beyond compliance. This Fact Sheet presents the following:

- The waste management hierarchy;
- Definitions of terms commonly used in waste management;
- How federal facilities can minimize their hazardous wastes at the source;
- Success stories; and
- Further sources of information.



The Waste Management Hierarchy

In the past, the predominant practice used by facilities who generate hazardous waste has been "end of pipe" treatment, incineration or land disposal. While this approach has provided substantial progress in improving the quality of the environment, there are limits to how much environmental improvement can be achieved using methods that manage pollutants after they have been created. Pollution control methods, for example, may not totally destroy hazardous wastes. Rather, they are put into land, water, or air where they disperse and migrate. Treatment alone will not remedy all hazardous waste problems either.

A hierarchy of hazardous waste management options is presented below, in descending order of preference:

1. Source reduction wherever feasible.
2. Environmentally-sound recycling.
3. Treatment of waste that cannot be prevented or recycled.
4. Disposal of waste only as a last resort.

Preventing the generation of hazardous waste, is inherently preferable to controlling it after it is produced. Minimizing hazardous waste at the source will, in fact, lead to the greatest level of environmental protection and provide significant economic benefits. This Pollution Prevention Fact Sheet deals with source reduction, the priority option for managing hazardous wastes. Source reduction which is sometimes referred to as "waste minimization," will ensure a healthful environment for us all.



How Federal Facilities Can Minimize Hazardous Wastes at the Source

Establishing an aggressive source reduction program is not necessarily difficult. It does, however, require commitment from top level management and an organized, comprehensive and continual effort to systematically reduce pollutants and wastes. Each federal facility should adopt its own program for waste reduction and define it formally in a written document.

Definitions of Terms Commonly Used in Waste Management

Waste Minimization: Reduction, as much as possible, of hazardous waste generated or subsequently treated, sorted, or disposed of. It includes any source reduction or recycling activity that: either:
(1) reduces the total volume or quantity of hazardous waste; and/or
(2) reduces the toxicity of hazardous waste.

Waste minimization does not include the transfer of hazardous constituents from one environmental medium to another; concentrating waste to reduce volume, diluting the waste, nor treatment of waste by incineration or land disposal.

Source Reduction: Source reduction implies any action that reduces the amount of waste resulting from a process or a facility. Source reduction includes modifying processes; substituting feedstock or improving feedstock purity; implementing various housekeeping and management practices; increasing the efficiency of machinery; and recycling within a process.

Recycling: Recycling implies use, reuse, or reclamation of a waste, either on-site or off-site, after it is generated by a particular process. It also refers to reclaiming useful constituent fractions within a waste material or removing contaminants from a waste to allow it to be reused.

Treatment: Any method, technique or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste. Treatment may neutralize such waste, recover energy or material resources from the waste, or render such waste less or non-hazardous. Involves end-of-pipe destruction.

Disposal: Discharge, deposit, injection, dumping, spilling, leaking, or placing of waste into or on land or water, so that such waste or any constituent thereof may enter the environment.

Undertaking hazardous waste minimization at the source will provide numerous benefits for federal government departments including:

Economic Incentives:

- Reducing waste storage, transportation and disposal costs.
- Avoiding costly alternative treatment technologies.
- Decreasing raw supply materials costs.

Regulatory Compliance Incentives:

- Decreasing compliance requirements with reduced waste load.

Liability Incentives:

- Potentially reducing long-term liability for employee safety and for environmental problems on or off the work site.

Public Image Incentives:

- Showing a concern for the environment & the community.
- Showing a concern for worker safety and health.



Waste Minimization Opportunity Assessments

A waste reduction assessment is sometimes called a "waste reduction audit". It is conducted by either an in-house assessment team or with an outside expert.

A waste reduction audit is a study of waste generation and waste management. It is a detailed, systematic analysis of every activity that results in the generation of waste. A thorough waste reduction audit should define the sources, quantities and types of waste being generated; analyze current waste management systems and practices; help set targets for waste reduction, reuse and recycling; and increase employee awareness of waste information and concern for waste reduction.

Directory of Ontario Green Industries

This directory provides an overview of the companies operating in Ontario's environmental industry sector. It lists over one hundred companies that work in the field of hazardous waste. In order to receive a hard copy of this listing, contact:

Ontario Ministry of Environment and Energy
Green Industry Office
135 St. Clair Avenue West, 5th Floor
Toronto M4V 1P5
Tel: (416) 323-4597 Fax: (416) 323-4436

A waste reduction audit can be broad or narrow in scope. Most facilities usually find it more effective to select a few waste streams for intensive assessment rather than to cover all waste streams at once.

A waste minimization workplan may be developed once the types, amounts and origins of waste generated are established. The workplan generally consists of an action plan to reduce, reuse or recycle many of the wastes.

For more information on how to establish a Pollution Prevention Program, please refer to Pollution Prevention Fact Sheet #2 - Establishing a Pollution Prevention Program. For more detailed information on hazardous waste management, refer to

COMPRO #12 - Regulations for the Management of Hazardous Waste.

Table 1 below outlines the five general elements of a waste audit.

<p>1. Inventory of raw material supplies and waste sources:</p> <ul style="list-style-type: none">•material and waste balances;•sources of chemical use and waste generation;•points of waste discharge;•chemical profile of wastes (why they are hazardous); and•waste disposal costs. <p>2. Priority framework:</p> <ul style="list-style-type: none">•review chemical hazards;•assess risks;•identify management criteria for importance;•assess economic, technical and environmental feasibility; and•prioritize wastes for the reduction program. <p>3. Process decisions:</p> <ul style="list-style-type: none">•identify housekeeping and production changes aiding reduction;•survey literature and equipment for proven technologies; and•estimate cost of waste reduction (include initial costs, amortization, depreciation, tax rebates, pay back potential). <p>4. Schedule and goals:</p> <ul style="list-style-type: none">•identify measurable goals;•establish outcome objectives and range of acceptability;•identify steps or phases of implementation;•identify tasks and personnel assignments;•train and involve all personnel affected; and•set target dates and planned costs for completion of goals. <p>5. Monitor, evaluate and follow-up:</p> <ul style="list-style-type: none">•identify reporting procedures; and•establish evaluation protocol•follow-up on any improvements necessary to success of the project..
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Table 1: Five General Elements of a Waste Audit

If your facility's resources are too limited to undertake a comprehensive waste reduction audit, staff members may be able to identify short-term, low-cost solutions that can minimize hazardous wastes rapidly. The waste minimization program may begin modestly and "graduate" eventually to more long-term solutions requiring capital investment for process or equipment changes.

Videos on Waste Auditing and Reduction

A waste audit can help a company or facility stay competitive by pointing the way to cost-cutting waste reduction measures. This is the message delivered by "The Competitive Edge", a video produced by the Ontario Waste Management Corporation (OWMC). The Competitive Edge is intended to be used to train employees in the basics of waste auditing and reduction. This video may be accessed through the Great Lakes Pollution Prevention Centre by calling 1-800-667-9790 or (519) 337-3423.



How Federal Facilities Can Minimize Their Hazardous Wastes At The Source

Improved Housekeeping and Operational Procedures

Improved housekeeping and good operating practices are often the most effective and simple first steps toward waste minimization. Improved housekeeping relies on using good common sense.

- Conduct frequent inventory checks to avoid over-purchasing and wasting inventory.
- Validate shelf-life expiration dates; return expired material to supplier.
- Use raw materials sparingly and in correct proportions.
- Segregate wastes according to toxicity.
- Inventory all products and waste, clearly labelling and properly storing them.

A close evaluation of how wastes are handled in your facility can present opportunities for reuse and recycling. For example, waste solvent from one operation may be clean enough to be used in additional applications. Small distillation units may be purchased to reclaim solvents on-site. Keeping waste streams separate can make reusing or reclaiming materials for other processes easier.

Materials Substitution

Materials substitution entails substituting non-hazardous products for hazardous materials currently used. Although material substitution is not possible in all situations, it can be an efficient part of a hazardous waste minimization program. As the demand for non-hazardous raw materials and products increases, more non-hazardous alternatives will become available.

Opportunities for materials substitution include painting applications, parts cleaning, metal finishing, building and grounds maintenance, etc. Performing a survey of the literature available on the subject, contacting industry associations, taking advantage of information clearinghouse resources, or talking to suppliers will allow you to identify alternatives for your particular operations.

An On-Line Resource: P2TECH Archive

P2TECH is an electronic Internet-based mail service that provides pollution prevention (P2) technical assistance providers with a means of sharing information, including material substitution. This archived information may be key word searched and is found at the following address: <http://gopher.great-lakes.net:2200/1/glin/majordomo>

The Solvent Alternatives Guide (SAGE)

SAGE is a tool which can be used to assist in the selection of surface cleaning alternatives. Designed to serve as an electronic handbook that identifies the most viable alternative for a given scenario, SAGE can be easily used and does not require a detailed knowledge of process chemistry or mechanics.

SAGE is available as a Windows based program, Winsage (1996), and as a downloadable PC version through the Control Technology Centre (CTC) in the United States. All that is required to gain access to SAGE is a PC with a modem. Further information can be obtained by calling the CTC Hotline at (919) 541-0800 or Internet at <http://es.inel.gov/ssds/ssds.html>

Preventive Maintenance

Maintenance may not be glamorous, but it is one of the most important aspects of waste minimization. It can accomplish about half of the total possible waste reduction through increased efficiency and simple process changes. Preventive maintenance activities include:

- Preventive maintenance schedules and procedures designed to reduce incidents of equipment breakdowns, inefficiency or process fluid leakage;
- Corrective maintenance such as resetting or adjusting control valves;
- Process temperatures to help increase efficiency and prevent loss of raw material in the waste streams; and
- Spill and leak prevention: changes to existing procedures to reduce waste resulting from spills or leaks.

Employee training in waste reduction can also reduce inadvertent waste generation. A detailed manual or set of operating instructions for each process could also increase safety and efficiency. Successful training in good operating practices and awareness-building programs include the following elements:

- Safe operation of equipment;
- Optimum process operating conditions and controls;
- Proper materials handling;
- Economic and environmental effects of waste generation and disposal;
- Detection of releases of hazardous materials;
- Safety hazards and solutions; and
- Emergency procedures.

These programs reduce occupational health and safety hazards in addition to reducing waste generation, and improved operating practices.

"It's Not Just A Drop in the Bucket" : P2 Through Preventive Maintenance

Produced by the Virginia Department of Environmental Quality (DEQ), this twelve minute video illustrates the importance of preventive maintenance and serves as a reference for developing and maintaining a program that will stop pollution before it starts at any type of facility. Available by calling the Virginia DEQ at (804) 762-4000 and the Great Lakes Pollution Prevention Centre at 1-800-667-9790 or (519) 337-3423.

Process Modifications

Improvements in both design and technology can have a significant impact in minimizing waste. Modifications can range from minor alterations made in a few days at low cost, to major investments over longer periods of time. Modifications may include the following:

- Changes in the production process;
- Equipment, layout, or piping changes;
- Use of automation; and
- Energy conservation.

Examples of recommended changes which help to minimize waste include rearranging processing sequences to allow recycling of rinse wastes; changing from wet to dry printing; eliminating toxic steps; eliminating wet plating baths; and direct reuse and recycling of waste.

Concurrent Technologies Corporation (CTC) in Johnstown, PA, for example, operates the National Defense Center for Environmental Excellence (NDCEE) for the U.S. Department of Defense (DoD). A Demonstration Factory, established in CTC's Environmental Technology Facility has clean manufacturing technologies that demonstrate and evaluate alternative processes and materials.

These clean technologies are believed to have the greatest potential for pollution prevention and waste minimization. The technologies focus on cleaning, organic recycling, inorganic finishing, coating removal, and process solution recovery and recycling. For more information about the NDCEE and CTC, call (814) 269-2804 or access their Internet Web site at <http://www.ndcee.ctc.com/>

Several different methods may emerge as practical solutions to a facility's waste minimization program. Often the combined implementation of these methods can significantly affect the total waste stream. Both employees and managers must be trained in waste minimization and given incentives to promote waste minimization practices. Rewarding employees' suggestions and actions can also motivate them to reduce waste.



Success Stories

A number of companies, municipalities and government organizations have adopted pollution prevention strategies that have helped them reduce environmental pollution and simultaneously improve their bottom lines. A few of these success stories are highlighted below.



Barrhead Cleaners, in Alberta, has replaced their traditional dry-cleaning machine with a new state-of-the-art machine. The previous dry-cleaning machine required a manual transfer of wet clothes to the drying unit which resulted in the loss of the dry-cleaning solvent, perchloroethylene, through evaporation. With the new dry-cleaning machine, the clothes remain in the same drum from the time they are placed in the machine until they are dry and ready to be removed, reducing the loss of solvent through evaporation.. Within dry-cleaning machines, dirty perchloroethylene is regenerated through distillation, resulting in clean, reusable solvent and a contaminated sludge. The new dry-cleaning machine also

has a more efficient distillation-refrigeration unit which results in better solvent recovery.



Chrysler Canada has undertaken a number of programs to help reduce pollution including the "Pay as Painted" program. The company now pays its paint supplier based on the number of vehicles painted. This program encourages the supplier to minimize waste. Over the past year, Chrysler, its employees and its paint supplier have worked together to develop efficient techniques and processes that have resulted in shared savings of \$2 million and a reduction of 14,000 gallons of paint waste. As another example, Chrysler switched from solvent-based paints to water-based paints, eliminating the need to clean paint lines with solvent. As a result, air emissions have been reduced by 75%. These initiatives represent a win-win situation for the environment, Chrysler and its suppliers. This success story can be accessed on the Internet at: <http://www.cciw.ca/green-lane/environment-week/success-stories/intro.html>



The City of Waterloo Pesticide Task Force, formed in 1990, has made fifteen turf management recommendations aimed at the elimination of pesticides, and seven educational strategy recommendations for promoting awareness of alternatives to pesticides. This successful program has resulted in a reduction in the amount of turf sprayed with pesticides from 72% in 1979 to 2% in 1993, although designated green space areas had increased by 150%.



The North Fabrication Plant of General Motors of Canada Ltd. produces plastic and metallic automotive components. Recently, a new finishing method involved in the manufacture of control arms has been implemented. The previous lead chromate pigment based paint was replaced with a lead free pigment paint that does not require phosphate pretreatment. With the zinc phosphate process eliminated, plant waste treatment sludge has been reclassified as non hazardous. The elimination of the lead chromate means that there is no longer any sludge resulting from the paint filtering operations.

Success Stories

Does your department have a pollution prevention success story to share? Other government departments in Ontario would like to hear about your experience in dealing with a particular problem. Please provide relevant information to the Pollution Prevention Coordinator, Federal Programs Division, Environment Canada. We will ensure that all interested parties obtain this information.

Further Sources of Information

Audit and Reduction Manual for Industrial Emissions and Wastes. 1992. ISBN# 92 807 1303 5. United Nations Environment Programme (UNEP), France. Tel: 33-1-44 37 1450; Fax: 33-1-44 37 1474.

Canadian Environmental Solutions. Specific solutions to environmental problems including profiles of companies that provide those solutions. CD-ROM. 1996. Industry Canada. Call the Environmental Affairs department at (613) 952-9564.

Guidelines for Environmental Auditing: Statement of Principles and General Practices. Z751-94. Contact the Canadian Standards Association at (416) 747-4000.

Industrial Waste Audit and Reduction Manual. PIBS#3394. July 1989. Ontario Waste Management Corporation. Available from the Ontario Ministry of Environment and Energy Public Information Centre at 1-800-565-4923 or (416) 325-4000.

Pollution Prevention Guidance Manuals (industry or process - specific). Examples include: auto repair, commercial printing, mechanical equipment repair, metal finishing, and research and educational institutions. Office of Research and Development, U.S. EPA. Washington. (513) 569-7562.

Reference Workbook: Pollution Prevention Plans. DOE FRAP 1994-35. For more information call the Fraser Pollution Abatement Office at (604) 666-5900.

For further information about the Pollution Prevention Program for federal facilities in Ontario, please contact:

Environment Canada
Ontario Region - Environmental Protection Branch
Federal Programs Division
49 Camelot Drive
Nepean, Ontario, K1A 0H3
phone: (613) 952-8675
fax: (613) 952-8995
e-mail: fpd@ec.gc.ca

All Fact Sheets can be found on the Internet at:
www.on.ec.gc.ca/epb/fpd
(aussi disponible en français)