POLLUTION PREVENTION OPPORTUNITIES ASSESSMENT

OVERVIEW: Pollution prevention is the process of reducing or preventing pollution at the source through changes in production, operation, and materials use. Pollution prevention can result in reduced materials usage, pollution control, and liability costs. It can also help protect the environment and may reduce risks to worker health and safety.

The improved Pollution Prevention Opportunities Assessment module focusses on workplace practices and equipment (other than the substitutes being evaluated in a CTSA) that can be used to reduce pollution at the source. It also describes methods individual businesses can use to identify pollution prevention opportunities, which often apply to many or all of the substitutes being evaluated.

GOALS:

- Perform a pollution prevention opportunities assessment for the specific process under consideration.
- Arrive at a specific list of actions which can be implemented to prevent pollution.

PEOPLE SKILLS: The following lists the types of skills or knowledge that are needed to complete this module.

- Knowledge of the process under review, including the types and amounts of chemicals used in the process; the sources, nature and quantity of waste streams; and process optimization techniques.
- Knowledge of waste tracking for the process under review, including access to records of rates of materials purchases and associated costs.
- Knowledge of federal, state, and local waste stream release reporting and historical waste disposal practices.

Within a business or DfE project team, the people who might supply these skills include a plant engineer, environmental engineer, line supervisor, line operator, or suppliers of chemicals or equipment.

DEFINITION OF TERMS:

Pollution Prevention: As defined in the Pollution Prevention Act of 1990, pollution prevention is the reduction in the amount or hazards of pollution at the source (see Source Reduction).

Recycling: In-process recovery of process material effluent, either on-site or off-site, which would otherwise become a solid waste, air emission, or a waste water stream.

Reuse: On-site recovery and subsequent introduction of a waste stream back into the process.

Source Reduction: As defined in the Pollution Prevention Act of 1990, any practice which: (1) reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and (2) reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. Source reduction includes equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.

Waste Management Hierarchy: National policy declared in the Pollution Prevention Act of 1990 which gives the following hierarchy to waste management, ordered from highest to lowest level of desirability:

- Pollution prevention at the source.
- Recycling in an environmentally safe manner.
- Treatment in an environmentally safe manner.
- Disposal or other release into the environment only as a last resort and in an environmentally safe manner.

APPROACH/METHODOLOGY: The following presents a summary of the technical approach or methodology for conducting a pollution prevention opportunities assessment. Steps 6 and 7 of the methodology concern implementing pollution prevention opportunities which would normally be done by individual businesses outside of the CTSA process. These steps are presented here to emphasize the importance of following through on a pollution prevention program.

Since the overall CTSA mainly focuses on pollution prevention through process modifications, reformulation or redesign of products, and chemical substitution, the methodology presented here focuses on identifying equipment modifications and improved workplace practices to prevent pollution. Further methodology details for Steps 3 and 4 follow this section.

Step 1: Obtain the process flow diagram from the Chemistry of Use & Process Description Module. The process flow diagram from this module provides the framework to identify process input and output streams, including waste point sources.

Step 2: Review the Workplace Practices & Source Release Assessment module to identify the types and quantities of hazardous and non-hazardous releases to air, land, or water, and the workplace practices associated with these releases.

Step 3: Evaluate each of the sources of releases and the associated workplace practices identified in Step 2 for pollution prevention opportunities. The best results occur when all plant personnel are involved in discussions to identify pollution prevention opportunities. In addition, EPA and many state agencies have prepared industry-specific guides to pollution prevention. Many states also provide pollution prevention technical assistance to small- and medium-sized businesses.

Step 4: Evaluate each of the pollution prevention opportunities identified in Step 3 to set priorities for implementing a pollution prevention activity. Factors that could be considered include:

- Company priorities (e.g., for the elimination of a "problem" chemical such as an EPA-regulated solvent).
- Relative amounts of waste streams.
- Relative toxicity of waste streams.
- Percentage of an existing waste stream that would be prevented.
- Regulatory status of waste streams, both before and after a pollution prevention opportunity is implemented.
- Employee health (e.g., cancer risk) and safety (e.g., fire risk).
- Cost of waste steam management (e.g., treatment and disposal costs).
- Ease of implementation.
- Cost of implementation and payback period.
- Potential for waste stream recyclability or reuse.
- Potential for regulations that may phase out certain chemicals or processes.

Step 5: Prior to implementing pollution prevention opportunities, review federal, state, and local regulations relating to the waste stream(s) under consideration. The Regulatory Status module should have relevant information pertaining to existing wastes streams, but may not cover new waste streams or changes in waste stream characteristics that would result from implementing a pollution prevention measure. This step is needed to assure that pollution prevention measures do not result in a violation of existing regulations. For example, if a pollution prevention measure would result in a waste water discharge of a regulated substance beyond acceptable limits, the measure would have to be eliminated from further consideration. Measures that shift pollution from one media to another or create new waste streams are not typically considered to be pollution prevention, however.

Step 6: Develop a schedule for implementing technically and economically feasible pollution prevention opportunities. (Pollution prevention projects are usually more cost-effective than indicated by traditional costing methods that lump environmental compliance costs into an overhead cost factor and do not consider potential liability costs and less tangible benefits. See the Cost Analysis module for more details.)

Step 7: Conduct periodic, in-house audits to assess the effectiveness of the pollution prevention program and to identify new pollution prevention opportunities on a regular basis.

METHODOLOGY DETAILS: This section presents the methodology details for completing Steps 3 and 4. If necessary, additional information on conducting a pollution prevention opportunities assessment can be found in the published guidance.

Details: Step 3, Identifying Pollution Prevention Opportunities

Pollution Prevention through Improved Workplace Practices

Improved workplace practices that prevent pollution are often inexpensive and easy to implement, while offering almost immediate reduction of waste. The basic framework for pollution prevention through improved workplace practices involves:

- Raising employee awareness of pollution prevention benefits.
- Materials management and inventory control.
- Process improvement.
- Periodic in-house audits.

Raising employee awareness is the best way to get employees to actively participate in a pollution prevention program. Materials management and inventory control includes understanding how chemicals and materials flow through a facility to identify the best opportunities for pollution prevention. Process improvement through improved workplace practices includes reevaluating the day-to-day operations in a facility to identify good operator practices that prevent pollution. Finally, in-house audits are used to collect real-time data on the effectiveness of a pollution prevention program. This step gives both operators and managers the incentive to strive for continuous improvement.

Examples of process improvements through improved workplace practices include:

- Training operators in techniques to optimize the process (e.g., manual adjustment of pH levels to extend the life of a plating bath).
- Training of employees to not "overuse" materials (e.g., only using the amount needed to perform a particular task).
- Covering containers to reduce evaporative losses (e.g., covering solvent containers while not in use).
- Covering containers of chemicals between process steps to minimize contamination.
- Improved inventory control (e.g., using chemicals before the listed expiration date).
- Improved handling of materials (e.g., training of personnel to reduce spills and wastage of liquids and solids).
- Segregation of raw materials and waste streams.

Pollution Prevention through Equipment Modifications

Modifying equipment to prevent pollution is usually more complicated and costly than changes in workplace practices. However, substantial improvements in process operation can be achieved through equipment modifications that are not equipment, process or technology substitutions. For example, pollution prevention through equipment modification for a chemical reactor/chemical delivery system could include:

- Increasing reactor volume and monitoring residence time to obtain an increased product yield.
- Installing sample loops on product sampling purge line to return unused sample to the process.
- Using an adjustable applicator system to control the quantity and direction of a chemical product (e.g., cleaning agent, paint or coating, etc.) applied to a substrate.
- Installing a recirculation system to recirculate chemicals that are being discarded before they are completely spent.

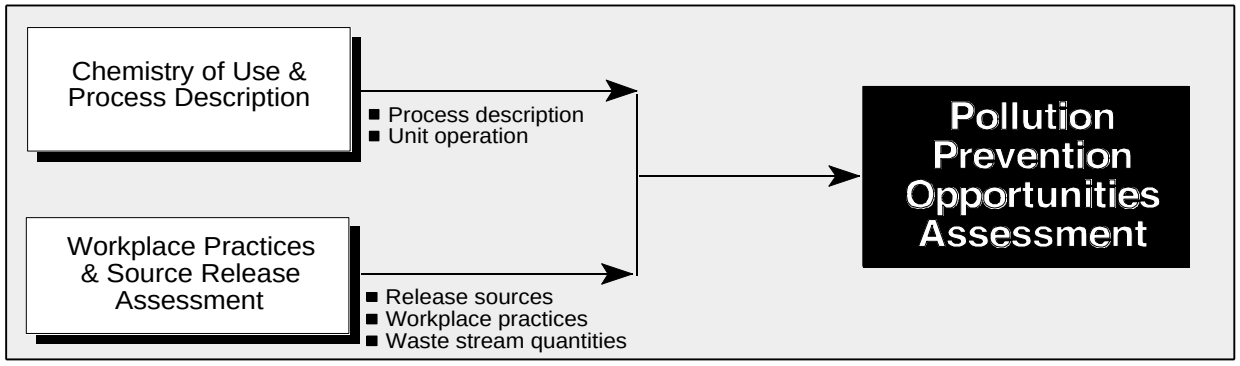
Details: Step 4, Setting Priorities

The percentage of a waste stream that would be prevented by a pollution prevention activity can be estimated based on:

- Knowledge of chemical reactions and mass and energy balance calculations.
- Professional judgement and process experience of the process specialist, waste manager, process operator and others familiar with the process.
- Data provided by vendors (e.g., chemical vendors).
- Data from published case studies of similar waste streams or facilities (see reference section).

FLOW OF INFORMATION: This module can be used alone to help identify pollution prevention opportunities in a commercial business or manufacturing facility. In a CTSA, this module receives data from the Chemistry of Use & Process Description and Workplace Practices & Source Release Assessment modules. Example information flows are shown in Figure 9-1.

FIGURE 9-1: POLLUTION PREVENTION OPPORTUNITIES ASSESSMENT MODULE: EXAMPLE INFORMATION FLOWS



ANALYTICAL MODELS: None cited.

PUBLISHED GUIDANCE: Table 9-1 presents examples of published guidance on performing a pollution prevention opportunities assessment. Additional guidance can be obtained by contacting the U.S. Environmental Protection Agency's Pollution Prevention Information Clearinghouse at (202) 260-1023.

TABLE 9-1: PUBLISHED GUIDANCE ON PERFORMING POLLUTION PREVENTION OPPORTUNITIES ASSESSMENT

Reference	Type of Guidance
Brown, Lisa, Ed. 1992. *Facility Pollution Prevention Guide.*	Methods for performing assessments, ranking of pollution prevention options, and assessment of waste reduction benefits.
Freeman, Harry M. 1994. *Industrial Pollution Prevention Handbook.*	Technical reference on pollution prevention strategies and technologies.
Higgins, Thomas E. 1989. *Hazardous Waste Minimization Handbook.*	Outlines specific approaches to industrial pollution prevention.
Metcalf, Cam, Ed. 1991. *Waste Reduction Assessment and Technology Transfer Training Manual.*	Example of pollution prevention assistance provided by many states. Check with local state agencies for a state specific guide.
Theodore, Lewis and Young C. McGuinn. 1992. *Pollution Prevention.*	Outlines assessment procedures.
U.S. Environmental Protection Agency. 1992h. *Pollution Prevention Information Exchange System: User Guide Version 2.1*	Users guide on accessing online database and performing information searches.
U.S. Environmental Protection Agency. 1992i. *Pollution Prevention Case Studies Compendium.*	Case studies of pollution prevention assessments.
U.S. Environmental Protection Agency. 1992j. *Guide to Pollution Prevention: The Metal Finishing Industry.*	Provides pollution prevention guidelines for specific industries. Call EPA at (513) 569-7562 to obtain guides for other industries or processes.
U.S. Environmental Protection Agency. 1992k. *PIES. Pollution Prevention Information Exchange System*.	On-line data base containing a compilation of different types of pollution prevention data.
U.S. Environmental Protection Agency. 1994m. *Pollution Prevention Directory.*	Directory of U.S. pollution prevention sources.

Note: References are listed in shortened format, with complete references given in the reference list following Chapter 10.

DATA SOURCES: None cited.