14. POLLUTION PREVENTION

Contents Page

List of Tables

List of Figures

Related Websites

Pollution Prevention (P2) Homepage: http://www.epa.gov/opptintr/p2home
EnviroSense: http://es.epa.gov/
Pollution Prevention Information Clearinghouse (PPIC):
http://www.epa.gov/opptintr/library/ppicindex.htm

This page intentionally left blank.

14. A. Overview of Pollution Prevention

Pollution prevention is a proactive environmental management approach for minimizing material and resource losses during production. Pollution prevention addresses all aspects of production processes from raw material usage and inventory procedures to waste management and utilities conservation. Management techniques that incorporate pollution prevention reduce or eliminate the generation of pollutants, wastes, and adverse ecological impacts through new approaches, material substitutions, and optimizing processes and operating procedures.

Pollution Prevention Goals

The goal of pollution prevention is to reduce pollution by eliminating or reducing waste. Pollution prevention is a multimedia approach that minimizes or eliminates pollutants released to land, air, and/or water without shifting pollutants from one medium to another. The Pollution Prevention Act of 1990 defines source reduction as:

> ...any practice which reduces the amount of a hazardous substance, pollutant, or contaminant entering any wastestream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and any practice which reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

Pollution prevention, therefore, represents a fundamental shift in approach away from the conventional reliance on waste treatment/disposal or "end-of-pipe" treatment to the active investigation of prevention techniques. Facilities can implement pollution prevention by:

- Modifying Equipment or technology
- Modifying process or procedure
- Reformulating or redesigning products
- Substituting of raw materials
- Improvements in housekeeping, maintenance, training, and/or inventory control.

Waste Management Hierarchy

A facilities pollution prevention program should eliminate or reduce the generation of pollutants and wastes at the source by carefully considering material usage, production processes, and waste management practices. The facility's pollution prevention program should identify opportunities for reducing the use of hazardous materials and waste generation or releases, as well as opportunities to protect natural resources by conserving and efficiently using energy and water.

The Pollution Prevention Act of 1990 includes a Waste Management Hierarchy that describes a comprehensive waste management program. The hierarchy assigns the highest priority to source reduction and places a decreasing level of preference on recycling, treatment, and disposal. To be most effective, a facility's pollution prevention program should focus on implementing source reduction. Where source reduction cannot be achieved, reuse and recycling projects should be implemented. If there is no feasible pollution prevention alternative, treatment and disposal should be used as a last resort. Figure 14-1 is a graphic representation of the waste management hierarchy. Each level of the hierarchy is described below.

Source Reduction

Source reduction refers to the use of materials, processes, or practices that reduce or eliminate the quantity and toxicity of wastes at the point of generation. By preventing waste the need for costly treatment and disposal is decreased. Source reduction can be achieved by substituting raw materials improving operating practices and changing processes and equipment.

- **Substituting Raw material:** Replacing hazardous materials with less hazardous (or less toxic) alternatives reduces releases to the environment of hazardous materials and wastes resulting from routine production processes and accidental spills. Examples of material substitutions include, but are not limited to, (1) substituting soy-based or water-based ink to replace solvent-based ink for printing, (2) using recycled paper instead of virgin stock, (3) replacing styrofoam packing materials with re-usable hard-pack plastic materials for shipping products, (4) eliminating trichloroethylene as a cleaning agent by substituting a caustic cleaner such as potassium hydroxide or sodium hydroxide, and (5) eliminating Freon® use.

- **Improving operating practices**: Improved operating practices can reduce waste generated from poorly developed standard operating procedures, inadequate training, and inefficient production scheduling. In the past, facilities developed operating practices that maximized production without taking into account factors such as raw material usage, waste disposal costs, and environmental impacts. Examples of improved operating practices include, but are not limited to, segregating waste, improving housekeeping, and establishing preventive maintenance, training, and outreach programs.

- **Modifying processes and equipment modifications**: In the long run, one of the most effective source reduction techniques may involve process and equipment modifications. Changes to processes and equipment present significant opportunities for source reduction and pollution prevention. Such modifications include using newer or more efficient equipment or redesigning a process so that less raw material is required, yet product quality is maintained.

Recycling

While source reduction prevents wastes from being generated, recycling turns by-products and wastes into reusable products. Recycling includes such practices as onsite or offsite recycling, materials exchange or reuse, and raw materials recovery.

- **Onsite/offsite recycling**: Both onsite and offsite recycling can help reduce dependence on expensive virgin materials by reusing spent materials.

- **Materials exchange or reuse**: A materials exchange system maximizes the use of a facility's excess raw materials and equipment. A system generally consists of a database for tracking the availability of excess materials by department (or whatever organizational unit is appropriate). In addition, a materials exchange system may include a communication link with the facility's supply system to alert stock clerks that excess items are on hand and should be used prior to purchasing new stock.

- **Materials recovery**: Some of the by-products and wastes generated during production can be recovered and sold as commodities. For example, waste acids that no longer meet the requirements of a final, critical cleaning process can be used in a secondary process that does not require the same level of cleanliness. Other examples of materials recovery as part of waste treatment are discussed below.

Waste Treatment

Unlike source reduction, waste treatment applies to wastes after generation. The goals of waste treatment technologies are to neutralize the waste, to recover energy or material resources, to render the waste nonhazardous, or to reduce the volume. Treatment technologies that enable material to be recovered include ion exchange, reverse osmosis, electrolytic metal recovery, and electrodialysis. Volume reduction through evaporation is an example of treatment. Although volume reduction decreases the amount of wastewater, the absolute quantity of hazardous or toxic waste released to the environment is not reduced. In addition, equipment for volume reduction requires a capital cost and energy costs.

Waste Disposal

Disposal should be considered only when all other options are exhausted. Disposal is considered the least favored waste management method because of the associated costs, liability, and environmental impacts. In addition, a limited number of permitted waste sites are available for disposing hazardous material, and many of these sites are approaching capacity. Also, waste transportation may pose hazards. Finally, recordkeeping and reporting requirements associated with disposing hazardous wastes are an additional burden that can be avoided through preventive measures, such as source reduction.

Pollution Prevention Benefits

Figure 14-2 summarizes the direct benefits of pollution prevention practices for facilities. Source reduction improves the potential for environmental compliance. Because penalties for environmental compliance are becoming increasingly severe, compliance is a top priority.

Implementing source reduction measures can also reduce costs associated with waste management. Costs reductions may be experienced in expenditures for raw materials, waste disposal, transportation, handling and storage, training, management overhead, and emergency response. By decreasing the amount of hazardous waste shipped offsite for disposal, the facility may also reduce the costs associated with tracking and filing paperwork required for hazardous waste manifests. Future costs, such as remediation activities, can also be avoided with source reduction activities.

In addition, source reduction will produce positive health and environmental benefits. By maintaining fewer hazardous or toxic materials onsite facilities reduce occupational hazards, and, therefore, improve worker health and safety. Creating a safer workplace may reduce the need for expensive health and safety protection devices. Also, insurance cost may be lowered. A safer workplace will also improve employee job satisfaction. Reducing hazardous materials usage also decreases the volume of toxic substances released to the environment from spills, leaks, and air emissions.

The indirect benefits of pollution prevention may be equally significant. One indirect benefit is reduced liability. The Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) "cradle to grave" provisions stipulate that a generator remains responsible for all environmental damage resulting from its waste including damage that occurs after disposal. A pollution prevention program can generate goodwill in the community and workplace, enhance the facility's public image, and foster environmental awareness among employees.

Figure 14-1

Waste Management Hierarchy

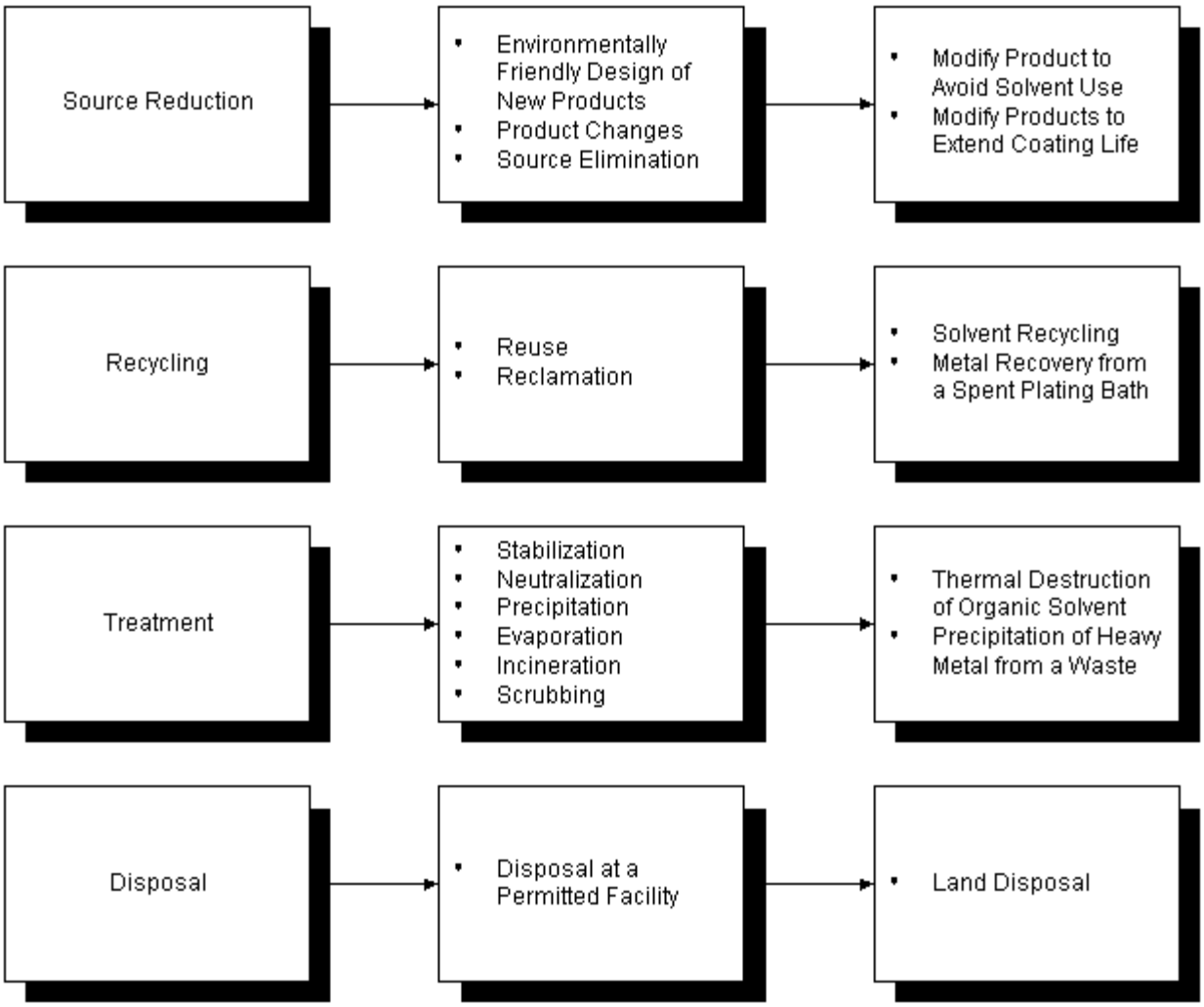

Figure 14-2

Benefits of Pollution Prevention

- Significantly reduces the amount of pollution released to the environment.
- Improves the potential for environmental and safety compliance.
- Improves worker health and safety by reducing occupational hazards.
- Provides the flexibility to choose cost-effective and environmentally sound solutions that will also result in improved efficiency and increased profit margins.
- Provides public recognition of a facility's efforts.
- Saves capital because of reductions in waste sent for costly treatment and disposal and because of decreased raw materials and energy usage.

14. B. Pollution Prevention Opportunity Assessment Procedures for Industrial Facilities

Because the primary objective of a routine National Pollutant Discharge Elimination System (NPDES) compliance inspection is to evaluate the facility's compliance with its NPDES permit requirements, a pollution prevention assessment incorporated into a compliance assessment may, by necessity, be limited. Nevertheless, the inspector can use these routine NPDES compliance inspections to identify pollution prevention options, particularly those options that would improve compliance. Alternatively, a facility visit may be conducted solely to evaluate the facility. In this instance, the general procedure for a facility visit is the same as that for any inspection (e.g., preparation, entry, opening conference, facility tour), but the specific focus is on identifying pollution prevention opportunities for the facility to investigate. Two reference documents the inspector may find useful are the *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003) and the *Facility Pollution Prevention Guide* (EPA/600/R-92/088). These documents contain procedures for conducting a pollution prevention opportunity assessment. Pollution prevention opportunity assessments have four phases: (1) planning and organization, (2) assessment, (3) feasibility analysis, and (4) implementation. The four phases are summarized in Figure 14-3.

The inspector cannot perform all the steps in the type of pollution prevention assessment described in the *Waste Minimization Opportunity Assessment Manual* (EPA/625/7-88/003) and in the *Facility Pollution Prevention Guide* (EPA/600/R-92/088). These documents were developed as guides for waste generators who want to implement a pollution prevention program. The feasibility analysis and implementation phases require development of criteria to screen and rank the options, conduct an in-depth technical assessment of options that can be successfully applied at that facility, conduct an economic evaluation, and the develop an implementation plan and schedule, which only the facility can determine. However, the inspector can evaluate whether the facility has conducted such an assessment and whether there are obvious pollution prevention opportunities.

It will be impossible, and unnecessary, for the inspector to have in-depth knowledge and understanding of all production processes and facility activities. However, as part of the entire pollution prevention assessment, whether during the preparation, interview, or facility site visit, the inspector should strive to become familiar with the facility layout, equipment and processes, points of potential waste generation, types of waste generated, and waste handling & disposal practices. If possible, the inspector should collect sufficient detailed information to develop a general flow diagram or material balance for each process step. The inspector should know the source, type, quantity, and concentration of each identified wastestream in order to identify data gaps, problem areas, and data conflicts.

As the assessment is conducted, the inspector should keep the pollution prevention principles in mind:

- Multimedia focus looking at all environmental media as a unified whole to avoid transfers from one medium to another

- Comprehensive evaluation of the total environmental impacts over the life cycle of the product, from raw materials through manufacturing (including energy use) to use and ultimate disposal.

Preparation

The inspector should prepare for the assessment by examining information about the processes, operations, and waste management practices at the facility. Any background material should be reviewed in the facility's file. If the inspection is planned to focus on pollution prevention assessment, the inspector should contact the facility to inform plant officials of this objective. During this initial contact, the inspector should ask for information that will help identify potential pollution prevention options. Table 14-1 provides a list of useful information for this assessment.

As the inspector reviews facility information, he or she should develop a list of questions specific to the facility. The inspector should be seeking, through the facility-specific questions, information to answer the following general questions:

- What significant wastestreams are generated by the plant? How much waste is generated?
- Why are these considered "waste"?
- From which processes or operations do these wastestreams originate?
- What is the production rate of each wastestream?
- Which wastes are hazardous and which are not? What makes them hazardous?
- How are the wastes managed at present?
- What are the input materials used that generate the wastestreams of a particular process or plant area?
- How efficient is the process? How much input material is:
  - Used in a process?
  - Released to water or air, or disposed of on land?
  - Destroyed or unaccounted for?
- What types of process controls are used to improve process efficiency?
- Are unnecessary wastes generated by mixing otherwise recyclable or recoverable hazardous wastes with other process wastes?

- What types of housekeeping practices are used to limit the quantity of wastes generated?

- Has the plant developed a Pollution Prevention Plan or strategy?

There are numerous documents that identify pollution prevention techniques for specific types of industry, such as the metal finishing industry, the fabricated metal products industry, and the pharmaceutical industry. These documents and other pollution prevention information can be obtained from:

- Pollution Prevention Information Clearinghouse (PPIC)

  - Guidance and information on Pollution Prevention Opportunities, (202) 566-0799, (202) 566-0794 (fax)

- Technology Transfer and Support Division [formerly Center for Environmental Research Information (CERI)]

  - Guidance and Information on Environmental Protection Programs, Publications Unit, U.S. EPA, 26 West Martin Luther King Drive, Cincinnati, OH 45268, (513) 569-7578, (513) 569-7585 (fax)

Interview

Just as with a routine NPDES compliance inspection, plant personnel should be interviewed when the inspector first arrives at the facility. The inspector should target personnel from the following areas:

- Management
- Environmental waste management
- Process engineering
- Facility maintenance
- Operation and production
- Safety and health
- Research and development
- Quality control
- Purchasing/inventory
- Shipping/receiving
- Storage.

From the interviews, the inspector should develop (or verify) a list of all waste minimization practices already in place. The inspector should also ask plant personnel for the plant's Pollution Prevention Plan or strategy and any suggested pollution prevention opportunities in the operations and processes and discuss with the plant personnel any pollution prevention opportunities that were identified during preparations for the site visit or during the onsite interviews.

Facility Site Visit

Again, as with a routine compliance inspection, the inspector should conduct a tour of the facility with plant personnel after the interview. The same areas of the manufacturing facility, materials and waste storage, loading and unloading, and treatment system should be reviewed. At each process area, the plant personnel most knowledgeable about the activity should describe the process or should answer any questions the inspector may have.

The inspector should make personal observations, seek confirmation of the interpretation of an activity that is occurring, and investigate any information plant personnel provide that appears to contradict what is being observed. The inspector should focus on:

- Loading and unloading operations
- In-plant transfers (raw materials handling)
- Process operations
- Housekeeping practices
- Maintenance activities
- Waste management operations.

The inspector should also check for signs of spills or leaks and assess overall cleanliness of the site. Throughout all the areas visited, the following wastestreams should be evaluated:

- Wastewater
- Air emissions, including stack and fugitive emissions (e.g., detectable odors and fumes)
- Hazardous wastes
- Nonhazardous solid wastes.

Each wastestream should be reviewed to:

- Determine whether the wastes are hazardous or nonhazardous
- Determine other physical and chemical characteristics of wastes and emissions
- Determine actual points of generation
- Determine quantities including variations
- Identify all handling, treatment, and storage procedures onsite.

Based on activities described above during a facility tour, the inspector should look for pollution prevention opportunities in the following general areas:

- Substituting less hazardous materials such as:

  - Using latex or water-based paints, rather than oil-based
  - Eliminating organic solvent cleaners and replacing with aqueous cleaners.

- Limiting the amount of hazardous materials disposed of by:

  - Buying only the amount of material the facility needs
  - Using all materials before their expiration date
  - Using only the amount of material needed

  - Sharing materials or donating extra materials to community organizations.

- Using and storing products carefully to prevent:

  - Accidents and spills
  - Mixtures of incompatible materials that can react, ignite, or explode.

- Recycling wastes, such as:

  - Used oil
  - Plastics, glass, paper, and metals
  - Spent solvents.

- Generating less pollution by:

  - Automating and improving process controls to optimize production operations
  - Allowing products to fully drain process chemicals before rinsing
  - Using less toxic materials (e.g., printing inks, dyes)
  - Adjusting production schedules to minimize cleanup operations
  - Sealing floor drains (permanently or temporarily) to prevent spills
  - Segregating wastes to support recycling (e.g., scrap metals, solvents).

- Turning waste products into new materials by:

  - Treating and recycling rinse waters
  - Recovering metals such as silver from waste materials
  - Recycling waste lubricants and coolants.

- Using fewer resources by:

  - Installing flow restrictors on rinse waters
  - Installing high efficiency boilers and furnaces
  - Using heat exchangers to heat process water supplies.

- Educating employees on the:

  - Goals of pollution prevention and waste management
  - Procedures to follow for waste disposal and pollution prevention
  - Accomplishments for the pollution prevention program being implemented.

Before leaving the facility, the inspector should meet with plant personnel. A list of pollution prevention options identified during the site visit should be prepared and discussed with plant personnel. Inspectors can discuss a pollution prevention technology or refer the facility representatives to EPA or State pollution prevention technical assistance offices. However, the inspector should not recommend specific measures to implement. Nor should the inspector suggest particular products or imply that a certain pollution prevention measure will enable the facility to achieve compliance.

Figure 14-3

Pollution Prevention Opportunity Assessment

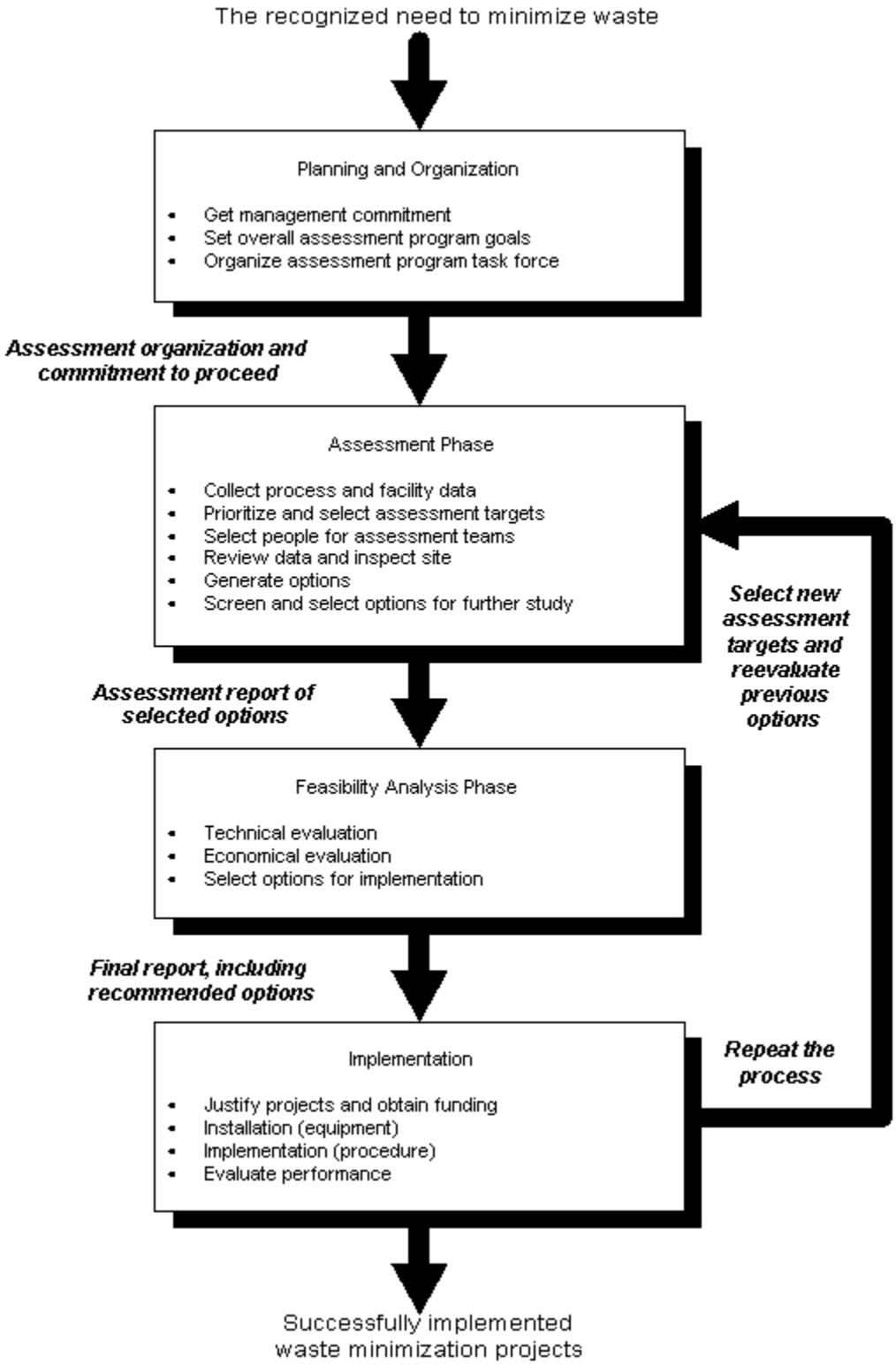

Table 14-1

Useful Facility Information to Conduct a Pollution Prevention Opportunity Assessment

Raw Materials Information

- Product composition
- Material Safety Data Sheets
- Product and raw material inventory and purchasing records
- Operator data logs
- Production schedules and records

Manufacturing Process Information

- Process flow diagrams
- Material and heat balances for production
- Manufacturing and pollution control processes
- Operating manuals and process descriptions
- Water usage rates
- Equipment and equipment specifications
- Piping and instrument diagrams
- Sewer layout diagrams
- Facility layout and elevation plans
- Equipment layouts and work flow diagrams

Waste Generation and Disposal Information

- Environmental permits—air emissions, solid waste, hazardous waste, NPDES, pretreatment
- RCRA information—manifests, annual reports
- Location of all wastewater, solid and hazardous waste collection, treatment, and storage points
- Diagram of air, wastewater, and/or hazardous waste treatment units
- Operating manuals for treatment units
- Emissions inventories [air, NPDES Discharge Monitoring Reports (DMRs), etc.]
- SARA Title III—Section 313 release reports
- Previous regulatory violations

This page intentionally left blank.

14. C. Pollution Prevention Opportunity Assessment Procedures For Municipal Wastewater Treatment Plants

The Municipal Water Pollution Prevention (MWPP) program promotes the application of pollution prevention concepts of the Pollution Prevention Act to Publicly Owned Treatment Works (POTWs). Pollution prevention can reduce the need for substantial capital investment in new infrastructure, enhance worker safety, improve the usability of sludge, and reduce operation and maintenance costs. Practices that stress a preventive approach to water pollution abatement include the following:

- Mechanisms for routine assessments of the compliance status of POTWs. This mechanism should include an early warning system based on periodic self-audits and quantitative techniques for assessing the condition of municipal wastewater treatment systems.
- Reporting processes on the capability of POTWs to sustain compliance.
- Processes for identifying, implementing, and tracking corrective actions to prevent pollution and maintain compliance.
- Program that will encourage POTWs to develop pollution prevention projects.

Pollution prevention practices POTWs can adopt could focus in the areas of:

- Improved operation and maintenance
- Projects that reduce wastewater flows and pollutant loadings
- Energy and water conservation
- Timely planning and financing for future needs and economic growth prior to occurrence of wastewater permit violations
- Toxicity reductions at the source (industrial pretreatment, commercial and residential source reduction programs)
- Recycling
- Proper treatment of wastes
- Beneficial uses of sludge.

Specific opportunities for optimizing each unit operation to maximize removal efficiency may include unit modifications to improve performance. For example:

- Clarifiers — Baffle installations and weir modifications to improve hydraulics and limit short circuiting.

- Aeration basins — Baffles to limit short circuiting. Fine bubble diffusers to improve aeration. Use of automatic controls to optimize aeration and limit over-aeration.

- Aerobic digester — Recover energy from gas. Insulate digester.

At any time, but especially during upgrading and expansion, the following pollution prevention projects could be considered:

- Install high efficiency pumps, motors and drives.

- Use biological- rather than chemical-based treatment.

- Install equalization basins to improve efficient operation of downstream units and minimize the need for oversize units.

- Design plant layout to minimize the need for intermediate pumping.

- Consider ultraviolet or ozone disinfection instead of chlorine.

- Digest residuals rather than heat or chemical treat.

- Select dewatering equipment not only to maximize solids but to minimize the need for chemical feeds that increase the volume of residuals.

- Evaluate toxicity of all lubricants, solvents, or cleaners, and replace them with less toxic alternatives such as citrus-based cleaners wherever possible.

- Reduce infiltration/inflow, which will result in several benefits:

  – Reduces plant expansion needs

  – Improves performance efficiency

  – Reduces grit (which increases equipment wear and breakage and is a disposal problem).

The Industrial Pretreatment Program is one of the best opportunities to achieve pollution prevention. It represents source control. Pollution prevention programs or projects aimed at residential and commercial users can also reduce loadings. Such pollution prevention programs could:

- Encourage water conservation

- Provide information on compatible or biodegradable cleaners to replace more toxic cleaners (for example, identify an alternative to chlorine-based "hang-in" type toilet bowl cleaners)

- Encourage composting instead of garbage grinders

- Enforce a commercial oil and grease ordinance requiring installation, operation, and maintenance of grease traps and recovery and recycle of oil and grease
- Discourage oil and grease dumping
- Prohibit disposable diaper flushing.

The POTW could also work with water utilities or agencies involved in establishing plumbing codes to reduce the metals (zinc, copper, and lead) found in drinking water supplies. These metals may be present because the water is corrosive to the pipes and leaches the metals from copper tubing, zinc-coated iron and steel pipes, and lead solder. The water utility may also be using water conditioning chemicals that contain metal salts.

The protocols for conducting a pollution prevention assessment at municipal wastewater treatment plants are similar to those for an industrial facility. The protocols of a Compliance Evaluation Inspection (CEI) are also appropriate, except that the focus during the interview, file review, and site visit is on identifying pollution prevention opportunities.

This page intentionally left blank.

14. D. References and Checklist

References

U.S. Environmental Protection Agency. July 1988. *Waste Minimization Opportunity Assessment Manual*. EPA/625/7-88/003.

U.S. Environmental Protection Agency. *Facility Pollution Prevention Guide*. EPA/600/R-92/088.

University of Tennessee. *Waste Reduction Assessment and Technology Transfer (WRATT) Training Manual*, 2nd Edition.

Municipal Water Pollution Prevention Program. March 1991. 21W-7002.

This page intentionally left blank.

POLLUTION PREVENTION CHECKLIST FOR INDUSTRY

A. GENERAL

Yes No N/A	1.	Is there a written facility policy regarding pollution prevention?
Yes No N/A	2.	Is there a pollution prevention program currently in place?
Yes No N/A	3.	Is there a specific person assigned to oversee the success of the program?
Yes No N/A	4.	Are there management/employee initiatives and incentive programs related to pollution prevention?
Yes No N/A		Quality circles (free forums between employees and supervisors) to identify pollution prevention options?
Yes No N/A		Opportunities for employee suggestions on pollution prevention options?
Yes No N/A	5.	Has the facility previously conducted a pollution prevention assessment?
Yes No N/A	6.	Has the facility used better cost accounting and cost allocation to provide incentives to reduce wastes or resource consumption?
Yes No N/A		Is cost accounting performed accurately for all process areas and wastestreams?
Yes No N/A		Are utility costs (energy, water) and waste treatment and disposal costs allocated to the operations that generate the waste?

B. STORAGE AREAS

Yes No N/A	1.	Are there designated material storage areas?
Yes No N/A	2.	Are storage areas clean and organized?
Yes No N/A	3.	Are containers stored in such a way as to allow for visual inspection for corrosion and/or leaks?
Yes No N/A	4.	Are containers stacked in a way to minimize the chance of tipping, puncturing, or breaking?
Yes No N/A	5.	Are there adequate distances from incompatible chemicals and different types of chemicals to prevent cross-contamination?
Yes No N/A	6.	Is one person responsible for maintaining storage areas?
Yes No N/A	7.	Does the layout of the facility result in minimizing traffic through material storage areas?
Yes No N/A	8.	Are stored items protected from damage, contamination, and exposure to weather?
Yes No N/A	9.	Are all storage tanks routinely monitored for leaks?
Yes No N/A	10.	Is containment, such as a curb or dike, installed in storage areas to contain leakage and to minimize the area contaminated by a spill?

POLLUTION PREVENTION CHECKLIST FOR INDUSTRY
(Continued)

B. STORAGE AREAS (Continued)

Yes No N/A	11. Are leak detection systems installed for underground storage tanks?
Yes No N/A	12. Are floating-roof tanks used for VOC control?
Yes No N/A	13. Are conservation vents used on fixed roof tanks?
Yes No N/A	14. Does the facility use vapor recovery systems?

C. MATERIALS INVENTORY

Yes No N/A	1. Is there an inventory control system designed to prevent materials from deteriorating in storage (first in, first out to prevent expiration)?
Yes No N/A	2. Is obsolete raw material returned to the supplier?
Yes No N/A	3. Does the facility try to order smaller containers of infrequently used materials to avoid disposing of large quantities of unused obsolete materials?
Yes No N/A	4. Has the facility tried to order larger containers of frequently used materials to reduce the number of small containers that must be cleaned and disposed of?
	5. Does the facility use or maintain:
Yes No N/A	Hazardous chemicals inventory lists?
Yes No N/A	Material safety data sheet files?
	6. Are all in-plant containers of hazardous chemicals labeled, tagged, or marked with:
Yes No N/A	Identity of the hazardous chemical(s)?
Yes No N/A	Appropriate hazard warnings?
Yes No N/A	7. Has the facility reexamined its need for each raw material?
Yes No N/A	8. Does the facility have a way to use off-spec material, where possible?

D. MATERIAL HANDLING

Yes No N/A	1. Are raw materials tested for quality before being accepted from suppliers?
Yes No N/A	2. Does the facility follow proper procedures when transferring materials?
Yes No N/A	3. Are expired materials tested for effectiveness before being disposed of?
Yes No N/A	4. Are drums, packages, and containers inspected for damage before being accepted?
Yes No N/A	5. Are containers properly resealed after use?

POLLUTION PREVENTION CHECKLIST FOR INDUSTRY
(Continued)

D. MATERIAL HANDLING (Continued)

Yes No N/A		6. Are containers emptied thoroughly before cleaning or disposal?
		7. Does the facility segregate its wastes as much as possible?
Yes No N/A		Solid wastes from aqueous wastes?
Yes No N/A		Nonhazardous from hazardous?
Yes No N/A		Segregated according to type of contaminant?
Yes No N/A		Different types of solid waste to improve recycling/reuse?
Yes No N/A		Different types of solvents, cleaner wastes, and lubricants (e.g., organic solvents from mineral oils)?

E. PROCESS OPERATIONS

Yes No N/A	1.	Are water conservation measures, recycling, and reuse techniques practiced in processes that use water or generate a wastewater (e.g., cleaning and rinsing operations)?
Yes No N/A	2.	Has material substitution been tried for any hazardous materials used in process?
Yes No N/A	3.	Have any techniques been used to increase the life of any process baths?
Yes No N/A	4.	Are any wastes being recycled, reused, or recovered in some manner?
Yes No N/A	5.	Have any equipment or process modifications been made to increase material use efficiency and thus reduce material waste generation?
Yes No N/A	6.	Do processes employ any detectors to alert personnel of malfunctions that could produce/generate excessive wastes?

F. SPILLS AND LEAKS

	1.	When a spill occurs, what cleanup methods are employed?
Yes No N/A	2.	Would different cleaning methods allow for direct reuse or recycling of the water?
Yes No N/A	3.	Are there preventive maintenance procedures designed to reduce incidents of equipment breakdowns, inefficiency, spills, or leaks?

G. MATERIAL SUBSTITUTION

Yes No N/A	1.	Could the facility modify or completely change a given process to use water-based coolants and fluids instead of oil-based fluids?

POLLUTION PREVENTION CHECKLIST FOR INDUSTRY
(Continued)

H. SOLVENT USE

	1. Can solvent cleaning be replaced with less toxic cleaning, such as:
Yes No N/A	A dry process (e.g., bead or sand blasting or other abrasives)?
Yes No N/A	Steam cleaning?
Yes No N/A	Cryogenic?
Yes No N/A	Caustic cleaning?
Yes No N/A	2. Are non-chlorinated solvents substituted for chlorinated solvents?
Yes No N/A	3. Are parts wiped to remove oil and dirt prior to solvent cleaning?
Yes No N/A	4. Is the loss of cleaning ability of the solvent monitored before the solvent is replaced?
Yes No N/A	5. Are chemicals reused or recycled?
Yes No N/A	6. Is an onsite distillation unit for solvent recovery and reuse installed?
Yes No N/A	7. Is solvent use standardized?

I. RINSE WATERS

Yes No N/A	1. Have excessive rinses been evaluated and eliminated?
Yes No N/A	2. Is rinse water reclaimed, pretreated, and reused?
Yes No N/A	3. Are water softeners used only where necessary?

J. TRAINING

Yes No N/A	1. Are there formal personnel training programs on raw material handling, spill prevention, proper storage techniques, and waste handling procedures?
Yes No N/A	2. Are employees trained in pollution prevention techniques?
	3. How often is training given and by whom?

K. GOOD OPERATING PRACTICES

Yes No N/A	1. Are plant material balances performed routinely?
Yes No N/A	2. Are they performed separately for each material of concern?
Yes No N/A	3. Are records kept for each waste, documenting sources of origin and eventual disposal?
Yes No N/A	4. Are operators provided with detailed operating manuals or instruction sets?
Yes No N/A	5. Are all operator job functions well defined?

POLLUTION PREVENTION CHECKLIST FOR INDUSTRY
(Continued)

K. GOOD OPERATING PRACTICES (Continued)

Yes No N/A	6. Are regularly scheduled training programs offered to operators?
	7. Has the facility integrated pollution prevention into supervision and management by:
Yes No N/A	Closer supervision to improve production efficiency and reduce inadvertent waste generation (increased opportunity for early detection of mistakes)?
Yes No N/A	Management By Objectives (MBO) with defined and achievable goals for waste minimization (better coordination among the various parts of an overall operation)?
Yes No N/A	Scheduling production to minimize cleaning frequency?
	8. Has the facility improved production scheduling and planning to include:
Yes No N/A	Maximizing batch sizes?
Yes No N/A	Dedicating equipment to a single product?
Yes No N/A	Altering batch sequencing to minimize cleaning frequency?
Yes No N/A	9. Is corrective maintenance practiced, such as resetting control valves or adjusting process temperatures, to increase efficiency and to prevent raw material loss through wastestreams?
Yes No N/A	10. Does the facility forbid operators to bypass interlocks and alarms, or to significantly alter set points without authorization?
Yes No N/A	11. Are overflow or malfunction alarms installed on tanks and equipment?

L. HOUSEKEEPING PRACTICES

	1. Good housekeeping is the maintenance of a clean, orderly work environment. Does the facility:
Yes No N/A	Maintain neat and orderly storage of chemicals?
Yes No N/A	Promptly remove spillage?
Yes No N/A	Maintain dry and clean floors by use of brooms and/or vacuum cleaners?
Yes No N/A	Provide proper walkways with no containers protruding into walkways?
Yes No N/A	Minimize the accumulation of liquid and solid chemicals on the ground or floor?
Yes No N/A	Stimulate employee interest in good housekeeping?

Checklist derived from Waste Reduction Assessment and Technology Transfer (WRATT) Training Manual, 2nd Edition, University of Tennessee

POLLUTION PREVENTION CHECKLIST FOR MUNICIPAL WASTEWATER TREATMENT PLANTS

A. AGE

	1. What year was the wastewater treatment plant constructed or the last major expansion to increase the capacity of the plant completed?
	2. What sewer system improvements does the municipality have under consideration for the next 10 years?
	3. What is the expected community and industrial growth?
Yes No N/A	4. Is there any major development (industrial, commercial, or residential) anticipated in the next 2 to 3 years, such that either the flow or pollutant loadings could significantly increase?

B. TREATMENT EFFICIENCY

	1. Compare influent actual flow to influent design flow. When will actual hydraulic loading exceed design?
Yes No N/A	Has the plant initiated expansion plans and financing sufficiently in advance to avoid overloading?
Yes No N/A	Has the plant investigated measures for reducing flow?
	2. Compare conventional pollutant loadings (BOD, TSS, ammonia, phosphorus) to design loadings. When will actual loadings exceed design?
Yes No N/A	Has the plant initiated expansion plans and financing sufficiently in advance to avoid overloading?
Yes No N/A	Has the plant investigated measures for reducing loadings?
	3. Review operating records. How many months were the effluent concentrations or loadings above 90 percent of the permit limits?
____ Mo.	BOD?
____ Mo.	COD?
____ Mo.	Fecal coliform?
____ Mo.	Other conventional pollutants limited by permit (ammonia, phosphorus)?
Mo.	Metals or other toxics?
	4. How many times were permit limits violated (in the last year)?
	5. What types of violations have occurred in the last 5 years?
Yes No N/A	Are any of a recurrent nature?
	What were the causes?
Yes No N/A	Have effective solutions been implemented to prevent future recurrence?

POLLUTION PREVENTION CHECKLIST FOR MUNICIPAL WASTEWATER TREATMENT PLANTS (Continued)

B. TREATMENT EFFICIENCY (Continued)

	6. How many bypasses have occurred? What were the causes? Yes No N/A Have effective solutions been implemented to prevent future recurrence?
	7. What are the future regulatory or permit requirements that may require modifications to the plant or its operations? Yes No N/A Can the facility currently meet any future anticipated water quality standards or effluent discharge limits?
Yes No N/A	8. Has the plant investigated ways to maximize operating efficiency?
Yes No N/A	9. Has the plant investigated improvements to the chlorination system to decrease chlorine usage?

C. SLUDGE

Yes No N/A	1. Does the plant have sufficient sludge treatment, storage, and disposal capacity?
	2. What percentage of the methane gas is captured and used? Yes No N/A Has the plant investigated ways to increase the amount of gas captured and used?
Yes No N/A	3. Has the plant investigated ways to decrease the amount of dewatering chemicals used?

D. COLLECTION SYSTEM

	1. How many overflows within the collection system have occurred?
	2. How many backups at any point in the collection system have occurred for any reason? What were the causes? Yes No N/A Have effective solutions been implemented to prevent future recurrence?
Yes No N/A	3. Has the plant investigated ways to decrease infiltration/inflow?

E. PREVENTIVE MAINTENANCE PROGRAM

Yes No N/A	1. Does the plant have a written preventive maintenance program on major equipment items and the sewer collection system?
Yes No N/A	2. Does the preventive maintenance program depict frequency of intervals, types of lubrication, types of repair and other preventive maintenance tasks necessary for each piece of equipment or each section of the sewer?

POLLUTION PREVENTION CHECKLIST FOR MUNICIPAL WASTEWATER TREATMENT PLANTS (Continued)

E. PREVENTIVE MAINTENANCE PROGRAM (Continued)

Yes No N/A	3.	Are these preventive maintenance tasks, as well as equipment and sewer collection problems being recorded, filed, and reviewed so future maintenance problems can be assessed properly?

F. MATERIALS USAGE

Yes No N/A	1.	Has the plant identified all supplies used in the operation and maintenance of the plant?
Yes No N/A	2.	Has the plant identified materials that could be substituted for less toxic materials?
Yes No N/A	3.	Does the plant reuse or recycle any materials used?
Yes No N/A	4.	Has the plant investigated ways to reduce chemical usage without compromising preventive maintenance or treatment?

G. PERSONNEL RESOURCES

	1.	Review personnel resources, training, and certifications.
Yes No N/A		Are there sufficient numbers?
Yes No N/A		Do all have appropriate certifications and periodic training?
Yes No N/A		Do all personnel certifications meet or exceed required levels?
		How many are below the required level?
Yes No N/A		Is staffing level equal to or does it exceed O&M Manual recommendations?
	2	What percentage of the wastewater budget is dedicated for training?

H. FINANCIAL

Yes No N/A	1.	Are the funds for the plant separate from other municipal funds?
Yes No N/A	2.	Are funds sufficient for adequate operations?
Yes No N/A	3.	Are funds sufficient for adequate preventive maintenance?
Yes No N/A	4.	Are funds available for necessary improvements, expansion?
Yes No N/A	5.	Is there a capital improvement fund?
Yes No N/A	6.	Is the equipment replacement fund in a segregated account?
	7.	What financial resources are available to pay for improvements/expansion/ reconstruction?

POLLUTION PREVENTION CHECKLIST FOR MUNICIPAL WASTEWATER TREATMENT PLANTS (Continued)

I. MUNICIPAL POLLUTION PREVENTION PROJECTS

Yes No N/A	1. Does the plant have a pollution prevention program or strategy?
Yes No N/A	2. Has the plant conducted a self-audit on the adequacy of its maintenance, operation, funding, and operator training?
Yes No N/A	3. Does the pretreatment program include a pollution prevention component or specific pollution prevention projects?
	4. Does the municipality have any pollution prevention projects aimed at reducing toxic/hazardous waste discharges, conventional loadings, or flow (e.g., water conservation) from:
Yes No N/A	Households?
Yes No N/A	Commercial businesses?
Yes No N/A	Industries?

This page left intentionally blank.